PUBLIC LIBRARY
CITY OF DETROIT
605 a 5 m.

AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

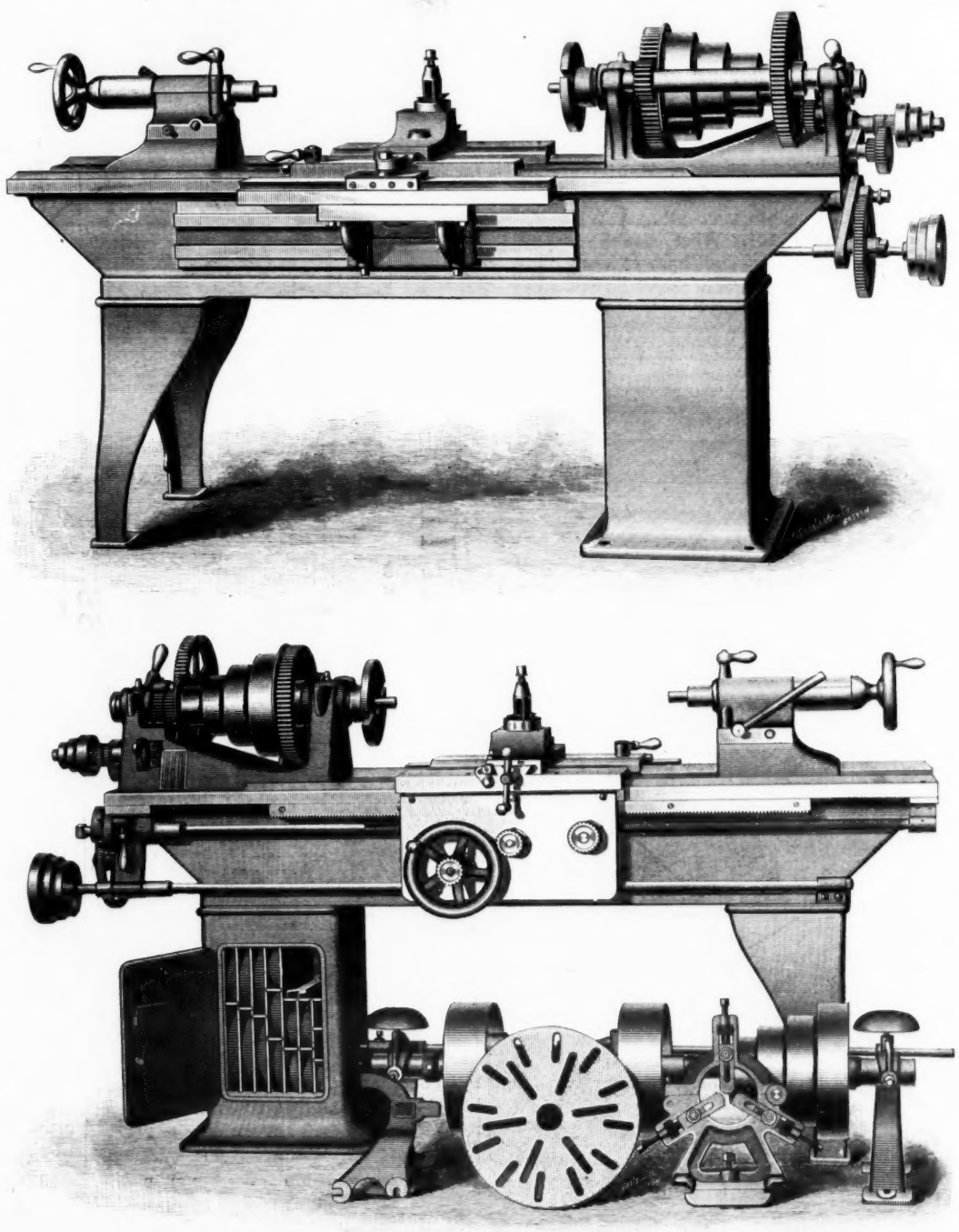
VOL. 12, No. 2. WEEKLY. | NEW YORK, THURSDAY, JANUARY 10, 1889. | $2.50 per Annum. SINGLE COPIES 5 CENTS.

COPYRIGHT 1889, BY AMERICAN MACHINIST PUBLISHING COMPANY. For Sale Everywhere by Newsdealers. ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

16-Inch Engine Lathe.

The engravings which we present herewith give a front and a rear view of a 16″ lathe, designed for general machine shop or tool room use. The lathe represented by the cut has a 6½″ bed, and takes between centers 3′ 4″, though they are built with beds of any desired length. As will be seen, it is quite heavily proportioned, has cones of large diameter for a 2½″ belt, and back gears proportioned 14 to 1. The spindles are of steel, ground on a Brown & Sharpe grinder and guaranteed round and true. The live spindle has a hole through it, 1¼″ diameter, the front bearing being 2⅜″ x 4½″, and the back bearing 2″ x 3½″. Change gears are provided for cutting threads from 2 to 48 per inch, and there is independent, belt driven, friction feed, and automatic cross-feed. Change gears, when not in use, are placed in the closet provided for them in the pedestal under the head, where they are protected from dirt and accidental injury. The legs, which are under the other end of the bed, are so arranged as to allow them to adjust themselves to slight inequalities or changes in the floor, without danger of cramping or twisting the bed.

The lathe is provided with the Slate taper attachment, arranged to turn or bore tapers up to 4″ to the foot. Weight of lathe complete, 2,200 pounds. The builders are The Hendey Machine Co., Torrington, Conn.



16-INCH ENGINE LATHE.

Self-Instruction for Young Mechanics.

BY FRANK RICHARDS.

II.

The last few years have seen the establishment of many technical schools. Money has been liberally contributed for their endowment, and all right-minded persons must applaud these noble gifts and hope that they be followed by commensurate results. But let no young and laudably ambitious mechanic, tied to the discipline of the practical shop, and held to the necessity of constant daily toil, look upon these schools in a way that shall operate to his discouragement. Let him not accept the impression that before long all the supervising skill of our manufactories is to emanate from these institutions. In the great army of labor, if it is ever to be believed that the officers are to be a class distinct and apart from the privates, how can it but have a disheartening effect upon the rank and file? But the young men in our shops need have no fear that any such insurmountable barrier will ever be established. There are no rounds missing in the ladder by which one may climb from the bottom even to the top, and numbers are still ascending on it.

Of course, the young mechanic needs, first of all, the keys that unlock the stores of communicable knowledge. When he has the three R's at his command—Reading, 'Riting and 'Rithmetic—he has a sufficient stock of tools to set himself up in the business of learning, and there is no reason why he should not become rich in it. The best way will be for him, not to try to grab everything at once. To get a good hold of one thing at a time is the way to secure the most. One who is working ten hours a day, and only using his evenings or other leisure time for studying, should take up only one subject and master that as far as he can, before he attacks another.

It ought not to be necessary to say—but it is necessary to say it over and over again—that whatever is undertaken requires, above all things else, thoroughness. That is an absolute necessity. To be successful in what you undertake to do or to learn, there must be nothing skipped or omitted as you go along. To do so, would be like leaving out part of a course of bricks when putting up a handsome and substantial building. That would be a ridiculous thing to do, only that it would be impossible, because when you came along with the next course of bricks, you would have nothing to lay them on. And that is just the difficulty that a fellow soon fetches up against, if he skips anything in a course of study. It is not the easy thing and the comparatively unimportant thing that one is ever tempted to skip. It is always the most difficult and the most essential ones that challenge the resolute will. I have known so many start to learn one thing or another at different times, and get stuck in it and give up in disgust. The disgust should have been with themselves. They went too fast. They did not make haste slowly enough. The insurmountable barrier would have been but a simple step, the same as the others, if they had taken all the preceding steps. The unintelligible point would have been clear, if all the preceding points and all their bearings had been properly mastered.

Now, the chief function of the professional teacher is only to enforce this thoroughness. The measure of his success in this one particular will be the measure of his success as a teacher. Recitations are only tests of the learner's thoroughness of preparation. Beyond the enforcement of this thoroughness, there are lines of study most essential to the mechanic, in which the teacher can do absolutely nothing to help him. Why, then, cannot the student just as well enforce this upon himself? Why could not two companions enforce it upon each other?

If I keep on in this strain, some one may suspect that I am trying to make out that the young machinist is just about the luckiest fellow in the world in the way of opportunity. Well, all may make their own inferences, but they must not deter me from stating the facts; and it certainly is the fact that the things most useful and necessary for the machinist to know are those where the professional teacher can help him the least. There is geometry, for instance. You take one of the standard text-books of geometry, and every particular is in the book, and there is nothing for the teacher to contribute. As a lesson in the matter of thoroughness, geometry is invaluable. I know of nothing so calculated to impress the importance of it upon the student. The connection of each successive step in geometry with all that have gone before, and the need of each to the complete establishment of those that follow, is plain enough to anyone that looks into it. But the thoroughness, I believe, is quite as necessary in other studies, where, perhaps, the necessity is not quite so evident. All the difference is, that in geometry we know precisely where the missing link fits in, and that it must be in its place before we can go much further.

Geometry is certainly the first thing of all that I would advise the young mechanic to go into. It is understood generally, I suppose, that all mathematics will be of value to the mechanic. Then why not set out to learn it all? And, if you are going to learn it all, why not in the regular order, as followed by the professional instructors? All I can say is that I know, unfortunately, how much, or rather how little, young mechanics are likely to learn of their own free will. By taking geometry first, they get what is of immediate and permanent value to them wherever they happen to stop. They can feel that they are laying up something of use to them from the very beginning. They encounter in geometry much to stimulate their interest and encourage them to persevere; or if they do not, they may be considered mentally unqualified for mechanical pursuits. It is a wonder to me that our young mechanics do not take to

geometry as the young ducks take to the water. All the same, they don't. One would think that the mechanical instinct would drive them into it. That it does not, can, perhaps, be best accounted for by one who understands the constitutional cowardice of the race. The fact is that the machinist is the most skittish of animals. He is ready to shy at the faintest shadow. I believe that the word geometry, or algebra, which is more terrible still, is enough to frighten many a one out of his wits. This is not a feeling to be proud of, to be encouraged or even tolerated. The way for one so afflicted to do, is to lead yourself right up to the bugaboo and take a good look at it. You will be ashamed that you were so silly when you have once fairly faced it.

Mathematics may be the life-blood of mechanics, but a sniff or a glimpse of it is still a terror to the mechanic, and the morbid sentiment compels our mechanical journals to pander to it, and make a merit of what is not a merit, the freedom of their columns from the appalling thing. This tyranny of a cowardly sentiment it would be well for them to resist as strenuously as it may be safe to do so.

There are many solid reasons why a young mechanic should first take up geometry. One is that it is so independent of everything else. You are not assumed to know a number of other things before you go into it. For instance, it is of no use to try to go into algebra until you are tolerably expert at arithmetic. But you can go a long way into geometry without knowing much more about arithmetic than that two and two are four. Then, as I was saying, geometry is so immediately useful to the mechanic. Whether he recognizes it formally and by name or not, it is his constant companion in the trade. Its principles are involved in every mechanical operation. The mechanic uses geometry just as the man had talked prose all his life without knowing it. Besides the practical value of geometry to the young mechanic, it should prove immediately of interest to him, from the ingenuity of its methods of demonstration. A fellow can't be much of a mechanic at heart that does not fall in love with it at first sight; so that the sooner he gets the sight the better. It is wonderful to realize how all the principles of geometry are got at in the first place. I have known it to prove a genuine surprise to some to find out that geometry does not depend upon experimenting or measuring, or cutting and trying for its results, that it is all done by what you may call pure head work, without any help of any other kind. A man might be shut up in a room alone, without instruments or apparatus, and reason out every fact of geometry.

Being based, as it is, on the lasting principles of things, it is not necessary for the student of geometry to have the newest textbook; and with the book in his hand he is fully equipped for the study, so that it is one of the cheapest of undertakings. I do not know that there is any better book to-day than the Davies' Legendre that I used more than thirty years ago. I think the first edition of it must be forty years old. A textbook on chemistry of the same age would be worse than worthless now, and one on natural philosophy or physics would be wrong in many particulars and lacking in many others.

The Engineer (London) says: "The five heaviest hammers in the world were built in the following order: Krupp, at Essen, 1867, 40 tons; Terui Works, Italy, 1873, 50 tons; Creusot, France, 1877, 80 tons; Cockerill, Belgium, 1885, 100 tons; and Krupp, Essen, 1886, 150 tons. They can take a vacation now."

Modern Locomotive Construction.

By J. G. A. Meyer.

EIGHTY-SECOND PAPER.

In finding the dimensions for the side rods in consolidation engines, the best mode of procedure will be to find first the dimensions for the central one. We have already seen that these rods are shorter than those in passenger engines, and therefore the cross-sectional area of the central side rod for consolidation engines is generally less than that of the side rods in passenger engines. Observation indicates that the average of good practice is to give one square inch in the cross-sectional area for every 6,000 pounds of the total maximum steam pressure on the piston; and that the depth of the central side rod is about 2½ times its thickness. Hence we have the following rules:

Rule 68. To find the cross-sectional area of the central side rods for consolidation engines. Divide the total maximum steam pressure on the piston by 6,000; the quotient will be the number of square inches in the cross-sectional area.

Rule 69. To find the thickness and depth of the central side rods for consolidation engines. Multiply the cross-sectional area (found by Rule 68) by 2, and divide the product by 5; the square root of this product will be the thickness. Multiply this thickness by 2½; the product will be the depth.

Example 101. What should be the thickness and depth of a central side rod for a consolidation engine having cylinder 20 inches diameter; maximum steam pressure on the piston 140 pounds per square inch?

The total maximum steam pressure on the piston is $314.16 \times 140 = 43{,}982.4$ pounds.

According to Rule 68, the cross-sectional area should be

$$\frac{43{,}982.4}{6{,}000} = 7.33 \text{ square inches.}$$

And according to Rule 69, the thickness should be

$$\sqrt{\frac{7.33 \times 2}{5}} = 1.71 \text{ square inches.}$$

The depth should be

$$1.71 \times 2.5 = 4.275 \text{ inches.}$$

Avoiding 32nds of an inch, we find that the thickness should be 1¾ inch, and the depth, 4¼ inches.

The front and rear side rods in consolidation engines have less work to do than the central ones, hence the cross-sectional area of the former can be less than that of the latter. In nearly all consolidation engines the thickness of all the side rods remains the same; we have therefore only to find the depth of the front and rear rods, which can at once be obtained by deducting a certain amount from the depth of the central one; the remainder will be the required depth for the front and rear side rods.

Rule 70. To find the depth of the front and rear side rods for consolidation engines. Multiply the depth of the central side rod by .08, and subtract the product from the depth of the central one; the remainder will be the depth of the front and rear side rods.

Example 102. What should be the thickness and depth of all the side rods for a consolidation engine, having cylinders 22 inches diameter; maximum steam pressure on the piston 140 pounds? We first find the dimensions of the central rod.

The total maximum steam pressure on the piston is

$$380.13 \times 140 = 53{,}218.2 \text{ pounds.}$$

According to Rule 68, the cross-sectional area of this rod should be $\frac{53{,}218.2}{6{,}000} = 8.85$ square inches.

According to Rule 69, the thickness of all the side rods should be

$$\sqrt{\frac{8.85 \times 2}{5}} = 1.88 \text{ inch.}$$

The depth of the central side rod should be

$$1.88 \times 2.5 = 4.70 \text{ inches.}$$

And the depth of the front and rear side rods should be $4.70 - (4.70 \times .08) = 4.33$ inches.

Avoiding 32nds of an inch, we find that the thickness of all the side rods should be 1⅞ inch; the depth of the central one should be 4$\frac{11}{16}$ inches; and that of the front and rear rods, 4⅜ inches.

The appended tables have been arranged by the foregoing rules.

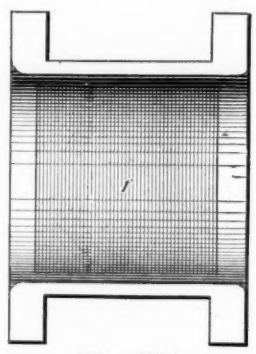


Fig. 467.

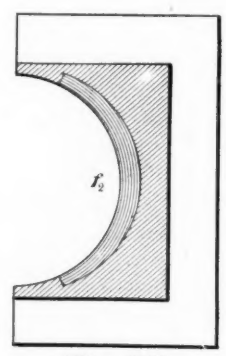


Fig. 468.

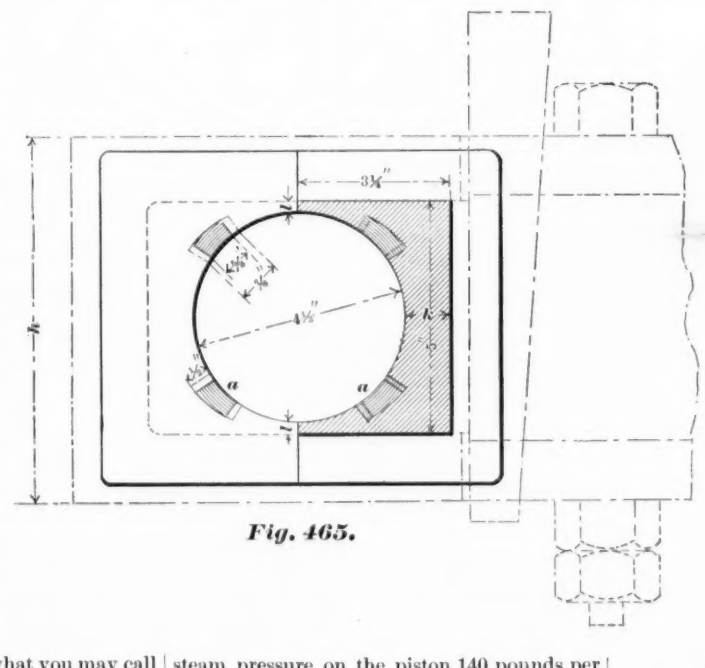


Fig. 465.

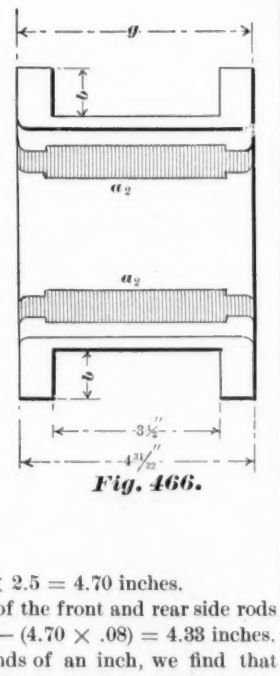


Fig. 466.

TABLE K.

Thickness and Depth of Side Rods of Uniform Rectangular Cross-Section, Made of the Best Hammered Iron, for Consolidation Engines. Maximum Steam Pressure on the Piston, 120 Pounds per Square Inch.

Diam. of Cylinders.	Thickness of all the side rods.	Depth of central side rod.	Depth of front and rear side r'ds
14″	1 1/16″	2 3/4″	2 1/2″
15″	1 1/8″	3″	2 3/4″
16″	1 1/4″	3 1/16″	2 7/8″
17″	1 5/16″	3 3/8″	3 1/16″
18″	1 7/16″	3 11/16″	3 3/8″
19″	1 1/2″	3 15/16″	3 11/16″
20″	1 5/8″	4 1/16″	3 15/16″
21″	1 11/16″	4 3/8″	4 1/16″
22″	1 3/4″	4 9/16″	4 3/8″

TABLE L.

Thickness and Depth of Side Rods of Uniform Rectangular Cross-Section, Made of the Best Hammered Iron, for Consolidation Engines. Maximum Steam Pressure on the Piston, 130 Pounds per Square Inch.

Diam. of Cylinders.	Thickness of all the side rods.	Depth of central side rod.	Depth of front and rear side r'ds
14″	1 1/4″	2 7/8″	2 5/8″
15″	1 1/4″	3 1/16″	2 13/16″
16″	1 3/8″	3 3/8″	3 1/16″
17″	1 7/16″	3 7/8″	3 1/4″
18″	1 1/2″	3 5/8″	3 3/8″
19″	1 9/16″	3 7/8″	3 9/16″
20″	1 5/8″	4 1/16″	3 3/4″
21″	1 3/4″	4 3/8″	4″
22″	1 13/16″	4 1/2″	4 1/8″

TABLE M.

Thickness and Depth of Side Rods of Uniform Rectangular Cross-Section, Made of the Best Hammered Iron, for Consolidation Engines. Maximum Steam Pressure on the Piston, 140 Pounds per Square Inch.

Diam. of Cylinders.	Thickness of all the side rods.	Depth of central side rod.	Depth of front and rear side r'ds
14″	1 3/16″	3″	2 3/4″
15″	1 1/4″	3 3/16″	2 15/16″
16″	1 3/8″	3 7/16″	3 1/8″
17″	1 7/16″	3 5/8″	3 5/16″
18″	1 1/2″	3 7/8″	3 1/2″
19″	1 5/8″	4 1/16″	3 11/16″
20″	1 11/16″	4 1/4″	3 7/8″
21″	1 13/16″	4 1/2″	4 1/8″
22″	1 7/8″	4 11/16″	4 3/8″

TABLE N.

Thickness and Depth of Side Rods of Uniform Rectangular Cross-Section, Made of the Best Hammered Iron, for Consolidation Engines. Maximum Steam Pressure on the Piston, 150 Pounds per Square Inch.

Diam. of Cylinders.	Thickness of all the side rods.	Depth of central side rod.	Depth of front and rear side r'ds
14″	1 1/4″	3 1/16″	2 13/16″
15″	1 5/16″	3 5/16″	3 1/16″
16″	1 7/16″	3 1/2″	3 1/4″
17″	1 1/2″	3 3/4″	3 7/16″
18″	1 9/16″	4″	3 5/8″
19″	1 11/16″	4 3/16″	3 7/8″
20″	1 3/4″	4 7/16″	4 1/16″
21″	1 7/8″	4 5/8″	4 1/4″
22″	1 15/16″	4 7/8″	4 7/16″

TABLE O.

Thickness and Depth of Side Rods of Uniform Rectangular Cross-Section, Made of the Best Hammered Iron, for Consolidation Engines. Maximum Steam Pressure on the Piston, 160 Pounds per Square Inch.

Diam. of Cylinders.	Thickness of all the side rods.	Depth of central side rod.	Depth of front and rear side r'ds
14″	1 1/4″	3 3/16″	2 15/16″
15″	1 3/8″	3 7/16″	3 1/4″
16″	1 7/16″	3 5/8″	3 3/8″
17″	1 9/16″	3 7/8″	3 9/16″
18″	1 5/8″	4 1/16″	3 3/4″
19″	1 3/4″	4 5/16″	4″
20″	1 13/16″	4 9/16″	4 3/16″
21″	1 15/16″	4 13/16″	4 7/16″
22″	2″	5″	4 5/8″

All main and side rods for which straps are used are provided with brass boxes, generally called "brasses." These are made in pairs, one brass being an exact duplicate of the other.

All main rod brasses for the crank-pin should be babbitted. We have known a few instances in which no babbitt metal was used, but such, as far as we have seen, proved to be a failure. Even when these boxes were made of phosphor bronze, babbitt metal was required to keep them cool.

Figs. 465, 466 represent the brasses in a main rod for the crank-pin, and show the amount and the location of the babbitt metal a_1 a_1 a_2 a_2 in these brasses. Sometimes these strips of babbitt metal are made of uniform width throughout, but we believe the best practice is to make the ends narrower than the central parts, as shown in Fig. 466, which will prevent these strips from slipping out of position.

In many cases these strips are placed at equal distances apart, as shown in Fig. 465, but we believe the best practice is to increase the distances between the strips and the joint of the brasses, so as to bring the center of these strips on lines, or nearly so, drawn from the center of the hole to the corners of the brasses. With this arrangement the strips will be in those portions of the brasses which contain the greatest amount of metal, and will not be so detrimental to strength of the brasses as in the positions shown.

Side rod brasses should also be babbitted, but there are many in use without it. When babbitt metal is used, it is inserted either as shown in Figs. 465, 466, or as shown in Figs. 467, 468. The former method we believe to be the best one, because, with the babbitt metal extending clear across the brasses, the crank-pin will wear more evenly than with the babbitt metal inserted as shown in Figs. 467, 468. This latter method should never be adopted for the crank-pin brasses in main rods.

Commutator Bars by Drop Forging.

For some time after the making of dynamo electric machines had developed into a business of considerable importance, the commutator bars were either cast of an alloy containing as great a proportion of copper as possible, or they were made in two parts, one of which (the main arm) was of pure copper, while the other smaller arm was of a castable alloy; the two parts being soldered, screwed or otherwise joined together.

These methods of making them were open to several serious objections. The conductivity of the alloy is not equal to that of pure copper, and those made in two parts, and afterwards joined, were expensive, and not equal in conductivity to what it was known a bar composed of one piece of pure copper would be, if it were made practicable to obtain such bars.

Mr. C. E. Billings, of the Billings & Spencer Co., upon perceiving these difficulties under which the electricians were laboring, conceived the idea that these bars could be made of one solid piece of unalloyed copper, by the same process which has done so much to advance manufactures in this country, and with which most of our readers are familiar in the working of iron and steel, viz.: drop forging. His proposition to furnish such bars was at first received with some incredulity, but such bars are now recognized as the standard, and tons of copper are used at the works in Hartford every month in their manufacture. By this process it is not only possible to use pure unalloyed copper, but a condition of the greatest possible density is secured, and, being formed from a cylindrical bar of copper, which, after "breaking down" and "drawing," is bent approximately to shape before "striking up," the grain or fiber of the copper is parallel to the longitudinal axis of any given portion of the bar, a fact which has its advantages in increasing the conductivity of the bar, and also its durability.

This, it will be seen, is an advantage which the drop forged bar would possess over one cast of pure copper, even if it were possible to make such castings, which in the present state of the art is not possible.

After being forged, pickled in acid and trimmed, they are cold pressed to the exact required thickness. Our engravings show the standard form of these bars, and the manner of securing them upon the armature shaft.

The Billings & Spencer Co. are now making them in sizes ranging from two ounces to four pounds in weight, for the Edison Machine Works, Thomson-Houston Electric Co., Westinghouse Electric Co., Waterhouse Electric and Manufacturing Co., Mather Electric Co., Schuyler Electric Co., Fort Wayne "Jenney" Electric Co., Electro-Dynamic Co., National Electric Co., and Richter Electric Co.—a list of users which indicates the favor with which the drop forged bars have been received. The success of electric lighting, and of the many other uses to which electricity has been and may hereafter be put, is partly due to the conception by Mr. Billings of the idea of drop forging these bars of pure copper, and to his reduction of the idea to a practical operation.

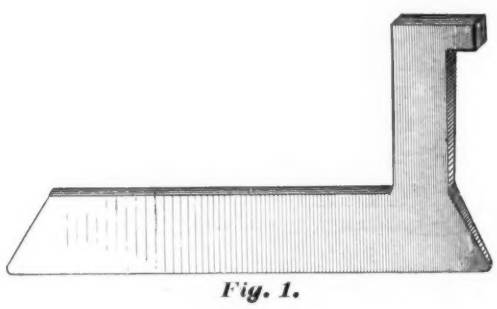


Fig. 1.

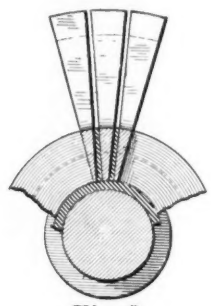


Fig. 3.

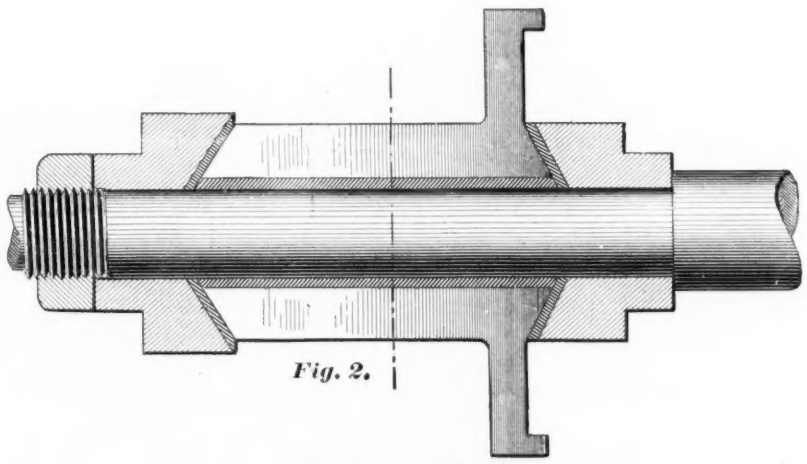


Fig. 2.

COMMUTATOR BARS.

Ships in Course of Construction at Wm. Cramp & Son's, Philadelphia.

Among the various vessels lying alongside the docks in Wm. Cramp & Son's shipyard, our representative noticed the U. S. Pneumatic Dynamite Gun Cruiser "Vesuvius." Through the courtesy of the members of the firm and its officers, he was given an opportunity to examine its internal arrangements. This cruiser has of late attracted a great deal of attention, on account of the new mode of warfare introduced by it—the principal new feature consisting of the introduction of the dynamite guns, perfected by Capt. Zalinski. Three of these guns are used; each one is 15 inches caliber. They are placed on the forecastle in an inclined position, and are set parallel to each other, with the vertical plane through the axis of the central gun passing through the longitudinal center line of the keel. They rest on the lower deck, pierce the upper deck, point in an oblique forward direction, and are all placed at equal heights above the keel. These guns or tubes are made in two parts; the upper parts, which are by far the longer ones, are permanently fixed or built in the vessel, the lower parts are pivoted so that they can be swung in vertical planes. The loading of these guns is manipulated much after the manner of loading a revolver. To accomplish this, the lower parts of these tubes are swung into a horizontal position, and thus brought into line with a huge horizontal revolving cylinder, divided into a number of chambers, which contain the projectiles. In this position, the projectiles are placed into the lower parts of the tubes; after this, the lower parts of the tubes are swung back into line with the upper portions, and the projectiles are then sent on their course of destruction, not by means of powder, but by compressed air. The general design of these guns is such as to maintain a rate of discharge of nearly two projectiles per minute, and their range will be greater than a mile; the range is regulated by the amount of air admitted to the dynamite gun. The object is to throw the projectile on the deck of an enemy, and any one who knows anything of the nature of dynamite can readily imagine the terrible effects of the explosion of these projectiles when they come in sudden contact with the deck of an enemy's vessel. No wonder that the British should call this craft "a hellish outcome of Yankee ingenuity."

The vessel is propelled by vertical, triple expansion, twin screw engines, each having one high-pressure cylinder, 21½ inches diameter; one intermediate cylinder, 31 inches diameter; and two low-pressure cylinders, 34 inches diameter; stroke of all, 20 inches. These and the auxiliary engines combined, develop 4,400 horse-power. Steam is furnished by four cylindrical locomotive boilers, having 200 square feet of grate surface; steam pressure, 160 pounds. Length of cruiser, 246 feet; breadth, 26½ feet; mean draft, 8½ feet; displacement, 700 tons; and guaranteed speed, 20 knots.

Two trials of speed have already been made, which seem to leave no doubt of obtaining the guaranteed speed; in fact, it is believed that a greater speed will be obtained. During the last trial a slight accident happened—one of the air pump levers broke, and consequently, this trial could not be completed satisfactorily. Before this accident, the average number of revolutions during a two-mile run was 274½ per minute. The breakage of the air pump lever is claimed not to be due to constructional weakness, but rather due to the lack of familiarity with the different parts of newly designed machinery during the severe tests to which this craft has been subjected. When this cruiser is seen from the docks, its lines cannot fail to call forth admiration and praise. The inside presents a large mass of machinery, and to one not acquainted with engineering, its machinery, although comparatively simple, may seem to be extremely complicated.

The designers of this vessel have just cause to feel proud of their achievement, and clearly demonstrate that Americans are capable of designing their own ships without copying the productions of foreign engineers. In fact, should this cruiser be as successful in time of war as is anticipated, another revolution in the design of war ships may be credited to the Americans besides the revolution in design caused by the famous monitors invented by Capt. Ericsson.

In entering Cramp & Son's works, one may be surprised at the great activity displayed. They have now the following ships in course of construction, supervised by their superintendent engineer, Horace See:

U. S. Cruiser No. 3, "Baltimore."
- Length.....335 feet.
- Breadth.....48½ "
- Mean draft.....19½ "
- Tons displacement.....4,400

Machinery: Horizontal, triple expansion, twin screw engines; four double-ended return tubular boilers; steam pressure, 135 pounds. Guaranteed indicated horse-power, 9,000.

U. S. Gunboat No. 1, "Yorktown."
- Length.....230 feet.
- Breadth.....36 "
- Mean draft.....14 feet.
- Tons displacement.....1,700

Machinery: Horizontal, triple expansion, twin screw engines; four cylindrical locomotive boilers; steam pressure, 160 pounds. Guaranteed indicated horse-power, 3,000.

U. S. Cruiser No. 4, "Philadelphia."
- Length.....335 feet.
- Breadth.....48½ "
- Mean draft.....19½ "
- Tons displacement.....4,400

Machinery: Horizontal, triple expansion, twin screw engines. Four double-ended, return tubular boilers; steam pressure, 160 pounds. Indicated horse-power, 9,500. Guaranteed speed, 19 knots.

U. S. Cruiser No. 1, "Newark."
- Length.....310 feet.
- Breadth.....49 "
- Mean draft.....18½ "
- Tons displacement.....4,083

Machinery: Horizontal, triple expansion, twin screw engines. Four double-ended, return tubular boilers; steam pressure, 160 pounds. Guaranteed indicated horse-power, 8,500.

Iron Steamship "El Mar," for the Southern Development Company of New York. Coastwise trade.
- Length.....352 feet.
- Breadth.....42 feet 8 inches.
- Depth.....31 " 8 "
- Mean draft.....18 feet.
- Tons, gross.....3,531

Machinery: Vertical, triple expansion engine. Four return tubular boilers; steam pressure, 160 pounds. Estimated indicated horse-power, 2,400.

Iron Steamship "Caracas," for Boulton, Bliss & Dallet, of New York (Red D Line), Venezuela trade.
- Length.....303 feet.
- Breadth.....40 "
- Depth.....29 feet 10 inches.
- Mean draft.....18 feet.
- Tons, gross.....2,500

Machinery: Vertical, triple expansion engine. Four return tubular boilers; steam pressure, 160 pounds. Estimated indicated horse-power, 1,800.

Another iron steamship, "New York," for the same parties, and same size, except 15 feet longer.

They are also building the engines for side-wheel steamboat "Connecticut," Providence and Stonington Steamship Company. Diagonal, compound, oscillating engine. Six cylindrical locomotive boilers; steam pressure, 110 pounds. Indicated horse-power, 5,000.

Locomotives Built at the Baldwin Locomotive Works.

The following is a record of locomotives built during the last year at the Baldwin Locomotive Works, Philadelphia, Pa.

	A	B	C	D	E	Total
January	—	1	10	17	26	54
February	—	—	17	4	34	55
March	—	—	17	28	21	66
April	—	—	17	34	5	56
May	—	—	30	30	5	65
June	—	—	16	13	27	56
July	—	—	9	33	14	56
August	—	—	25	3	37	65
September	—	—	13	26	27	66
October	—	—	20	27	28	75
November	—	—	7	30	21	58
December	1	—	7	30	27	65
	1	1	188	275	272	737

A.—Rack rail engines.
B.—Special single driver engines.
C.—Passenger engines, 4 wheels coupled.
D.—Six wheels coupled, freight and passenger.
E.—Consolidation and octapod engines.

All engines built during the last year were delivered on time. At present they are delivering some of the engines ahead of time.

After all, and this at the end of various schemes that had been brought forward, the managers of the Paris Exposition have ordered the machinery for operating the lift in the famous Eiffel Tower from an American firm—the Otis Elevator Co., of Yonkers, N. Y. The hydraulic cylinders for this lift are 38 inches diameter, and 39 feet 3 inches in length.

Making Corliss Engine Cylinder Patterns.

BY P. S. DINGEY.

It is often required in shops building engines that a cylinder pattern be so constructed that it will serve for engines of different strokes. To illustrate one way of making a pattern like this, I have chosen a Corliss engine cylinder. Fig. 1 shows the wrist-plate side and half section of cylinder. Fig. 2 is a section through *A B*, and Fig. 3 is a section through *A' B'*. As both halves of pattern are almost alike, it will only be necessary to deal with one-half.

Experience has taught me that $\frac{1}{16}''$ to the foot is enough to allow for shrinkage on a job of this kind. Use first quality dry lumber; it will pay to take some pains in selecting stuff for this pattern; for, if the lumber is not thoroughly dry before the pattern is completed, it will be found that dimensions are scant.

By referring to Fig. 4, it will be seen that, to make a pattern for different stroke engines, I have arranged it to slide like a telescope. I have shown it pulled apart a little. Fig. 5 is a section of Fig. 4 through *C D*; the lagging *a b c d e* in Fig. 5 is taken off in Fig. 4 to facilitate explanation. An inner box is first made, the length, width and depth of *f g h* in Figs. 4 and 5, and doweled together with iron dowel plates like sketch. Build out each side of this inner box for about half its length to width *G*, Fig. 1; then fasten on strongly four cross pieces numbered 1, 2, 3, 4. For future reference I will name this the "Fast End." In Fig. 5 the outside piece marked 8 should be made wide enough for the exhaust passage in Fig. 2. Notice that, in making the inner box, the piece *K* was left loose to form a part of the sliding end. On the sides of remaining half of box, glue and screw two guides marked *E F* in Figs. 4 and 5; on each side of these guides fit pieces that shall slide over them, and secure these pieces to the two side pieces that shall make the sliding end same width as fast end. Now fasten the cross pieces 5, 6, 7, to the sliding frame, and be careful not to get any of the pieces glued to the box. Let 5, 6, 7, be fastened to *K*, and to the side piece 8; the lagging *a b c d e* in Fig. 5 will hold this sliding end together, though, as the pattern progresses, it will have enough to hold it. The lagging *e* forms the core print for coring out the space that separates exhaust passage from body of cylinder. (See Figs. 1 and 2.)

We have now a foundation to build on, and have made it the width of *G* in Fig. 1. At this stage the length of the pattern, when closed for the shortest cylinder required, should be the length of cylinder, minus the thickness of two flanges and $1\frac{1}{4}''$ for fillets on back of flanges. Fig. 6 represents the pattern closed to its shortest length, with the framework of Fig. 4 all closed up.

Proceed next to get out the end flanges, valve chambers, port pieces, etc., and build on. Get out the flanges as shown in Fig. 8, glue on a piece $\frac{5}{8}''$ thick, represented by the dotted etching; this $\frac{5}{8}''$ thickness is for carving the fillets on backs of flanges, and makes by far the best job. It must be remembered that the cylinder illustrated here is supposed to be a standard pattern, from which a hundred or more castings may be taken, so that in this case the best way will be the cheapest in the end.

Glue and screw on the end flanges, Fig. 8, and side pieces *a' b' c' d'*, Fig. 6, for the valve chambers. Build some blocks together same shape as shown in Fig. 9, and fasten them in place at *J J*, to form the ends for steam valve chambers. For very large cylinders these pieces had better be boxed. For the ends of exhaust valve chambers *L L*, make plain square blocks; now make the exhaust passage the right height, by gluing on piece 9 in Figs. 6 and 7; after this, fit in the pieces 10, 11, 12, 13, Fig. 6, that give a thickness of metal over the steam and exhaust ports. All is now ready for rounding off the side of steam passage and corners, and cutting the fillets.

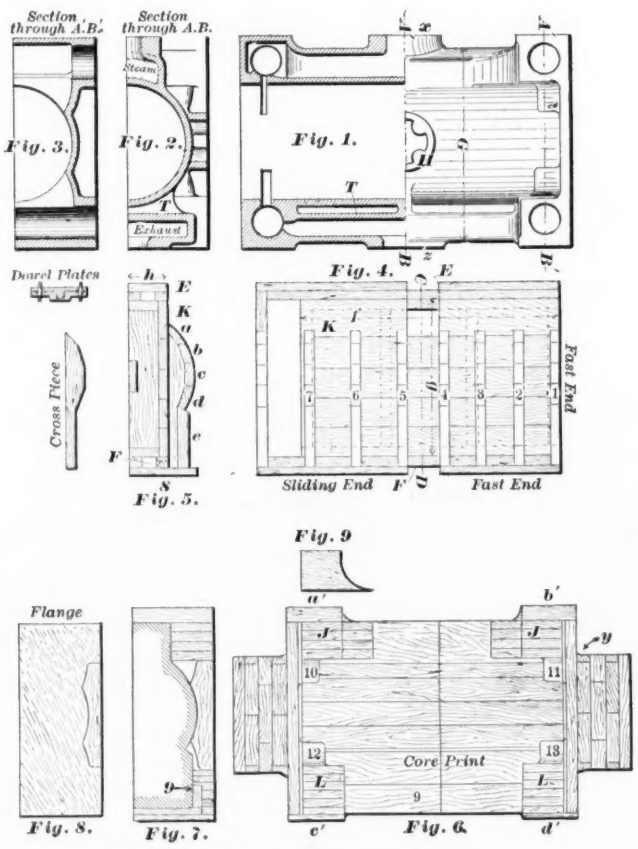
Check down the two inner edges on ends of valve chambers. (See Fig. 1.) This is to allow the bonnets to lap over and cover the joint of lagging. I have said that both halves of pattern were almost alike; the difference between them is, the center piece for bolting the wrist-plate to is usually on the opposite side of the small bosses that take the indicator pipe; also the valve chambers are made about one inch longer on the cope side of pattern than on the drag side. This is done to insure solid ends after this extra inch is planed off the casting. When casting these cylinders, all the dirt and flux that is in the mould and metal rise to those four high places and stick there; hence, the necessity of extra stock on the ends of valve chambers.

In turning the eight core points for the valve chambers, make those in the cope as much shorter than those in the drag as the extra stock just mentioned; in other words, the core prints should measure the same length from the joint of pattern on both halves. The necessity of this will be seen when we come to make the core boxes. Give these prints plenty of taper, because it will help the moulder to feel his way when dropping in the cores of valve chambers; it will also help to fetch the cores upright when dropping on the cope.

Now fit on the pieces *x z*, to take the exhaust and steam flanges (see Fig. 1), and as these pieces are to be removed for sliding the pattern out and in, they must only be doweled and screwed on. Screw the core prints on these pieces from the back. The center piece *H*, Fig. 1, should be put on in the same way. Build up the core prints for bore of cylinder as shown, and turn a flat fillet on them at *y*, Fig. 6. This will prevent crushing the edge of sand when putting the core in, or dropping on the cope. Turn these prints whole, and saw in halves with band saw after turning them; for large cylinders it will be better to stave up these prints. We may now consider the pattern finished for the shortest stroke; but, before leaving the pattern, it will pay, while the pattern maker is on the job, to slide the cylinder out 6" or 12", according to stroke of engine most generally wanted, and build a piece to go between.

The M. C. Bullock Manufacturing Co., Chicago, has built quite a number of different sizes of Corliss engines, and all of the cylinder patterns are made to slide. We have just completed a 32" pattern that is arranged for a 60" stroke and upwards, just as I have shown here.

There are many details which are omitted, because they are such as the pattern maker will naturally run against; so let us leave the pattern and start in on the core-boxes for the steam and exhaust passages, valve chambers, etc.; but before starting, let us take a rest; in the meantime, keep the Figs. 1, 2 and 3 before you, because I shall refer to them again.



CORLISS ENGINE CYLINDER PATTERNS.

LETTERS FROM PRACTICAL MEN.

Piece-Work.

Editor American Machinist:

Your recent articles bearing upon the growing question of the piece-work system have no doubt been welcomed by the great majority of your readers, who, like myself, have been trying to decide what is, and what is not, justice to employer and employed.

I should like to hear from Day Pay, what he considers his just dues are, his answer, of course, to hold good whether he speaks as planer hand, superintendent or employer.

It is a generally undisputed doctrine that a man should earn at least 25 per cent. more by piece than by day work, but the planer hand in the case in point, doing the work at the original figure, would clear about $55.00 per week, an amount out of all proportion to the market rate of the class of work being done.

I have no sympathy for the man who strains every nerve and machine, in order to break a record, and do a job in half an hour less time than his shopmates, and, on the other hand, could have little respect for a man who, in order to keep up a bad record, will use all his ingenuity in contriving means of killing time on a job.

It seems that few employers recognize the fact that, in hiring a man to run a machine, they pay him for that only, and that whatever he produces with his brains is morally as much his as though he had secured it by patent right; he can keep it locked up in his own head, or can give his employer the benefit of it, as he sees fit; and it is safe to say that no employer loses anything by paying fairly for any improved method of doing his work his men may devise, and there are few shops of any size, where some of the men do not continue to do work by old, worn-out methods year after year, simply because they know that if they do suggest a better way, they will not even get a thank you, or, what is far more galling, an unscrupulous foreman will manage to pocket all the credit.

Of course, Day Pay deserved substantial credit for improving the methods of doing his work but the figures he gives would indicate that his predecessor made way for a (better) mechanic, or an honest man, none too soon.

I know of nothing better calculated to systematize work in a shop, and set men to independent thinking, than the piece-work plan when fairly conducted; and with proper gauging, etc., men soon learn that it does not pay to turn out an inferior class of work.

The purpose and outcome of piece-work, of course, is to produce work cheaper and quicker; but the laws of competition, as a rule, take pretty good care that the employer shall not enjoy more than a fair share of the benefits of it for a very great length of time, but will compel him to divide it with humanity at large in the shape of cheaper goods for the masses.

C. GODFREY WHITAKER.

Cleveland, Ohio.

"Elastic" Rules.

Editor American Machinist:

If there is any one thing that gets my "dander" up real quick, it is to hear some people tell us that the rules to govern themselves should be so "elastic" as to stretch to circumstances.

When we read an article from a writer who is supposed to know his business, instructing us just how to manage and run a drawing room or shop, and find his closing statement to be, "This stuff is all made gum-elastic, gentlemen," it reminds one of shoddy clothing. If it is too big 'twill shrink, and if it is too small 'twill stretch. There is such far-fetched pathos in the joke, one wants to smile with a stuffed club. I won't criticise Jarno's "elasticity" any further than to quote the words of my German friend of the angle and square on the next block, who remarked, "It's bedder if Yarno didn't say somedings dot time."

But Tau's 'elastic system" strikes me as just what many of our shops are looking for. The drawing room would be complete, and I would suggest elastic drawing boards and T squares. Drawings for a ten horse-power engine so elastic they could be pulled out to fifty horse-power. An elastic vault so we could push it out and up as our needs increased. And, to be generous, let us carry the good work out into the shop, and have the lathes and planers constructed on the expansion-telescopic plan, just elastic enough to fit any job that happened along. No, Tau; I've heard of some banks and of brokerage businesses that were run successfully by elastic rules, and I know of several shops running on the elastic system, and that is about all they do, too. I've heard their managers go into raptures, too, over the beauties of method and system, but, if asked to explain their system, they failed. The great Eureka, "elastic," had not been discovered by our drawing room hobbyists yet.

I know that machine shops, pattern shops, drawing rooms, or business of any kind were never managed successfully under elastic rules and regulations or systems.

A fixed iron-clad system has built up the Pennsylvania Railroad into one of the grandest fabrics in the world to-day. Fixed methods, allowing of no deviation, are the corner-stones of our most successful manufacturers, and why a drawing room must be managed on the elastic plan is beyond my comprehension.

Some time ago I spent several hours in the drawing room of Cramps' shipbuilding works, Philadelphia, and it was a pleasure. The chief of that room never dreamed of mentioning that he had a system; 'twas unnecessary, for the very atmosphere was pervaded with method (none of your elastic stuff, either), and I noticed that it was not necessary to consult any "books" to find things, either. "Keeping books" in a drawing room is a superfluous luxury, elaborately drawn from theory. The complete key to the drawing room should be on the door of the vault if you have one, else on the case, and in as simple, concise form as possible, bearing in mind that old proverb, "A place for everything and everything in its place."

The arrow points on a drawing should be as bold and prominent as the dimension figures, because the workmen haven't time to experiment with a microscope trying to find which way is North on the blue prints. From personal contact with institutions run by

these "stretch and shrink" methods, I have seen that the rigid steel square system is the one that wins.

Another wrong idea is in having the various departments and the drawing room management on an equal footing. The drawing room must be in charge of an engineer capable of giving orders to the superintendent and responsible to the manager, or else the superintendent must control the draftsman and be the responsible party, otherwise there will be constant friction, unless the manager is a man thoroughly conversant with all the details of each department as well as his office work. I have noticed also, that the men who don't believe this doctrine are using the elastic system without knowing what ails them.

The old law that governs the world says, "There shall be but one God," and the same rule applies to every workroom and business throughout the globe. One man must govern and control. "Harmony" among several is sheerest nonsense; the reason is too obvious. The story of Damon and Pythias is a fable. "There is but one God in Israel" should be the name of one man only in every machine shop. His motto should be the old Mosaic law, "An eye for an eye, a tooth for a tooth," sprinkled with just enough of the golden rule to make a sauce for special occasions. I've tried it successfully.

I saw a kink in an Eastern drawing room that was new to me, and I like it. Red ink is used for section lining, making a very neat contrast with the black outlines on the tracings, and showing up well on the blue prints. Then it's "cheaper;" I almost forgot that. I would also suggest to some draftsmen not to make drawings "one-third size," unless they have a grudge against the pattern maker, in which case it's different.

But, above all things, let us have fixed, rigid methods in our shops and drawing rooms, and do away with these "elastic" systems, like unto the streets of Boston.

W. S. ROGERS.

System in the Drawing Room.

Editor American Machinist:

There is no department of a machine shop in which system and orderly method bring larger returns than in the drawing office, but there is no department, perhaps, in which system is so difficult to maintain. The perfect system for this purpose must so classify and file the drawings, that they can be readily found without an index; it must provide for recording future changes and improvements, so as to present a complete history of the development of each machine, and it must do this with but little expense and no red tape.

The great foe of system in the drawing office is hurry. A machine is sold for quick delivery. The shop is at a stand-still until drawings can be furnished, and any system which requires delay to carry it out, goes to the bow-wows. This is perhaps as it should be. Dispatch is one of the conditions of doing business—sometimes the condition paramount above all others—and a system which fails to meet this condition is simply inadequate for its purpose, and hence fails, as it should do.

The method described below savors but little of invention, it is true, but in my own work it fulfills every purpose; and the more cumbersome and expensive, but less satisfactory, plans which I find in use elsewhere lead to the conclusion that it may be worth presentation through the columns of the AMERICAN MACHINIST.

As a first step, the drawings are neither inked in nor preserved. They are finished in pencil only, and are then traced, after which they are discarded, to be eventually coated with the print solution and made into prints. The tracing finished, two prints are made from it, one for the shop and the other for office use. The latter—whose making may be, and usually is, deferred until all the tracings of the set are complete, with corrections, etc., made—is marked "Office Reference Print," by having a small piece of tracing cloth, bearing those words, placed below the title when exposing to the sun. Alongside this piece of cloth is put a piece of buff-colored paper, say 2″ x 1″, to give a blank spot on the print for future use in entering the date, when the plans there shown go out of date, or in making any memorandum that may be needed. The tracings are used for nothing except to make prints. They are kept in a case of drawers by themselves, which should be placed in a fire-proof vault. The office prints are used as originals for all purposes of reference, and are filed by having a drawer appropriated to each set of prints. When alterations are needed, if slight, the tracing is altered and its date changed; if extensive, a new tracing is made, and in either case new prints are made, while the old office print is endorsed on the white spot referred to, "Superseded, see print dated . . . ." If some part of some machine is found later on to be applicable to some new machine, two additional prints are made from the tracings, but with the title stopped off by a piece of buff-colored paper. On the white patch thus left is lettered by hand a new title for the new use of the part, and to this is added, "From tracing of . . . machine, dated . . . ." As before, one of these tracings is for office use, and becomes one of the set belonging to the new machine, thus making every set of plans complete at a trifling expense. To provide for those numerous cases where off-hand sketches answer every purpose, and save much time and delay, I provide pads of paper, about 10″ x 12″ in size, ruled into ¼″ squares by faint blue lines. These are ruled at the stationer's on a ruling machine at a trifling expense, and, while not of refined accuracy, answer this purpose perfectly. The squares enable one to sketch details rapidly and with sufficient accuracy, without the use of T squares or triangles. The sketches are inked with a writing pen and a bookkeeper's ruler, using ordinary copying ink, and for office use a letter-press copy is made in a copy book kept for that purpose. These sketches expedite matters greatly, and, if desired, can be put into more permanent shape and make profitable work at slack times, when such work is needed. If desired, after the original has worn out, prints can be made from the press copies. The yellow tinge of most copying inks causes the copy to make a much better print than would be expected.

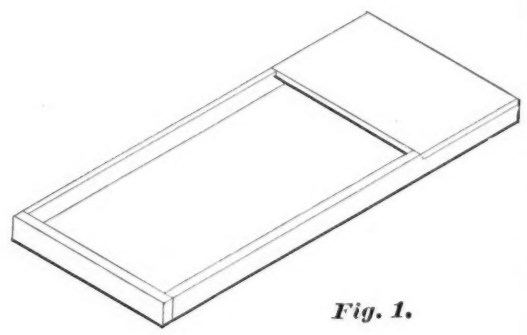


Fig. 1.

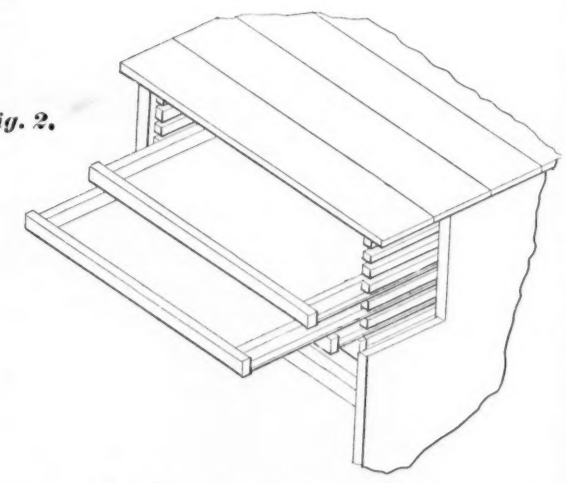


Fig. 2.

SYSTEM IN THE DRAWING ROOM.

For office use, there should be but one size of sheet. This and the shop's preference for small sheets of details can be met by confining the drawing of the details, which go together, to one-half or one-quarter of the sheet—putting other details of the same machine on the other half or the other quarters, and then cutting the sheets into parts for shop use, but leaving them uncut for the office. The results are one standard size sheet for the office, and three standard sizes for the shop.

The case of drawers for filing drawings is usually ill adapted to its use. The drawers are usually too large, and always too deep. They should be about an inch larger each way than the standard sheet, and should not be deep enough to encourage the putting of two sets of drawings into one drawer. For drawings or prints 1¾″, and for tracings 1½″ is amply deep enough. Each drawer for tracings should have a piece of heavy pasteboard as large as the drawer, to lie on the tracings and prevent curling up at the edges, and the back end of the drawers for prints should be covered over as shown in the sketch, Fig. 1, to keep them from rolling up and making trouble. To save wall space, the drawers should be so shaped that the sheets go in endways instead of sideways, and the sheets should have their titles on their upper left hand corners, in order to bring the titles into convenient view when the drawers are opened.

As cases of drawers are usually made, considerable waste room is involved in the partition piece and slide-way between the drawers. With the shallow drawers here advocated, this waste room may equal thirty or forty per cent. of the entire case, but it can all be saved by arranging the drawers as shown in the sketch, Fig. 2, or in some equivalent manner. The bottoms *a* are extended beyond the sides, and rest on slides *b*, each of which occupies the recess in the drawer next below, and consumes no vertical room, while the entire case vertically, save only the drawer bottoms, is available storage room.

The matters referred to herein are, perhaps, individually trifles, but collectively they add greatly to one's comfort in his work, while they cost nothing—drawings can be made in this way as or more cheaply than in any other. The practice of using prints instead of drawings as originals, involves, incidentally, the certainty that the office and shop drawings are duplicates, and no one can realize the comfort that this gives until he tries it.

FREDERIC A. HALSEY.

P. S. Since the above was writtten the AMERICAN MACHINIST for Dec. 17 has arrived, with the article on this subject by "Tau." Many of his ideas are in line with my own, but I cannot but ask the following questions: I. Why ruin your eyes on brown paper, which is to be thrown away and wasted, when, by using good, white paper, you can afterward make prints of it and so save it? (By the way, the best paper in the world, for both drawings and prints, is Weston's linen record; cheap, too.) II. Why have three sizes of sheets in the office, when it can be avoided by the device explained? III. Why file drawings according to number and size, thereby distributing the drawings of any given machine all over the case of drawers, and requiring an index to find them, when, by filing them as explained by me, the sets are kept together, and an index is superfluous?

F. A. H.

Condition and Prospects of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

Chas. A. Strelinger & Co. (Wood and Metal Workers' Tools, Builders' Hardware, etc.), Detroit, Mich., write us:

Our trade in tools, supplies and machinery, appertaining to metal working business, has been excellent during the past year. We have been very much crowded for room, and are now having erected for us a new store, three times the size of our present one. It is located on the corner of Bates and Congress streets, one square from our present location, and it will be about 65 x 100 feet, and six stories in height, provided throughout with electric lights, power elevator, etc.; will be strongly built and thoroughly equipped.

Dean Brothers Steam Pump Works (Steam Pumps and Water Works Machinery), Indianapolis, Ind., write us:

Our business for the year just closing is about twenty per cent. greater than the business of 1887. We look for a further increase of business next year. Competition is so sharp and prices so low that, in order to maintain profits, the business must be extended and increased.

Acme Machinery Company (Bolt, Nut and Special Machinery), Cleveland, Ohio, write us:

Our business for 1888 has been very satisfactory, and the outlook for 1889 is encouraging; so much so, that we are now building a 50 x 120 foot machine shop of brick, two stories high, lower floor 14 feet, upper floor 12 feet high. The lower floor will be used for setting up machines, and be provided with overhead traveling cranes, and all modern improvements for handling work economically. We are also building an L, 32 x 40 feet, to connect the new shop to our present plant. This building will be of brick, three stories high; the lower floor for offices and tool-room, each 15 x 40, the second floor for store room, and the third floor for drafting-room.

We have added several machine tools during the year, and lack of room has prevented us putting in more.

Labor is a shade higher than last year, and material a little lower, which makes prices of finished products about the same.

P. H. & F. M. Roots (Blowers, Exhausters, Valves, etc.), Connersville, Ind., write us:

We can say very briefly in regard to our business: First. We have done over $30,000 more work than ever before.

Second. We have three months' orders ahead, and prospects are very good.

Third. We rebuilt our works last spring, which nearly doubled our turnout; we found in a short time that our works were still not large enough, and have just completed another large building, which we intend to fill with machinery.

Fourth. Labor and material are both higher than a year ago.

The T. C. Dill Machine Co. (The Dill Disconnecting Device and General Machinists), Philadelphia, Pa., write us:

Because of the fact that we have been established in business but a few months, we cannot give you much information concerning our business for the year 1888. But for the future we have good cause to be hopeful, and by this time next year we believe that we will be able to report very encouragingly for 1889.

Besides our disconnecting device for valve rod, we are manufacturing a stub end for connecting rods, which rivals all others and costs less than half the price of any first-class stub end.

The Page Belting Co. (Belts, Belt Lacing, etc.), Concord, N. H., write us:

The year 1888, as it draws to a close, leaves us well pleased with its record, so far as our business is concerned. We have been able to largely increase our sales over former years, and have extended our business into markets both home and foreign. We have obtained many new customers in all parts of the country, and especially in the South, to which we have given some more attention than formerly. Several of the large new mills in the South have been equipped with our belting during the year. We have also shipped many large belts, as well as complete outfits, to other parts of the country, East and West, and to the extreme Pacific coast. Among these large belts we name a 52-inch belt, double, shipped from here December 26, for the Fort Wayne Janney Electric Light Co., Fort Wayne, Ind., whose works were recently consumed by fire, and who are now rebuilding. We have furnished some large belts also, very recently, for the Akron Iron Co., Akron, Ohio. We have largely increased our export business, not only in markets previously occupied by us, but have, during the year, established a considerable trade with Japan.

The outlook for business in the future is very encouraging. Our reports, with reference to the general business indications, are of a very satisfactory nature. There will unquestionably be a very large growth of manufacturing business during the year 1889.

D. Saunders' Sons (Gas and Steam Fitters' Tools), Yonkers, N. Y., write us:

Our business for the last year has been equal to 1887. The look-out for the coming year indicates an increasing and prosperous business.

The Hoggson & Pettis Manufacturing Co. (The Morris Type Writer, Lathe Chucks, Special Machinery, Dies and Tools, Stamps, Stencils, Cutting Dies, etc.), New Haven, Conn., write us:

We find, in looking over our books, quite an increase in volume of business over last year (fully one-third more), which was the largest year's business in our history. Our chuck department shows a gratifying increase of business, with a first-rate outlook for next year. The manufacture of patented articles, to which we have lately been giving more attention, has obliged us to increase our force, and spread out and occupy more room than heretofore; so that our factory, which four years ago had two empty floors, is now pretty well filled. With the addition of machinery, which we contemplate adding next year, it will hardly more than give us comfortable room. A recent purchase of adjoining real estate will enable us to extend our works, if we become cramped for room.

The Laidlaw & Dunn Company (Pumps, Tobacco Machinery, Pipe and Fittings, Railroad and General Supplies), Cincinnati, Ohio, write us:

We are very busy, indeed, in our "Duplex" pump department, and also in our hydraulic press department. We have bought eight new tools during the year, and have increased our working force about 25 per cent. We have had a very good year, and our prospects for the coming year are quite as good. The price of material has been about the same all the year, and there has been no change in the price paid for labor. We trust that our hopes for 1889 will be realized, and have every reason to believe that they will be.

Randolph Brandt (Selden Patent Packing, Mine, Mill and Steamship Supplies), New York, writes us:

From January to May the sales of "Selden packing" were close on to 25 per cent. greater than the same period in 1887, and I have increased my facilities since then, so I can carry a much larger stock in all sizes from ⅛ inch to 3 inches, varying by *sixteenths*, and will be enabled to fill orders for the coming spring trade much prompter than heretofore.

Prices for materials, labor and product are about the same as in 1887.

During the past summer and fall there was not the same proportionate increase of sales as in the spring. Buyers have generally been keeping their stocks low during the past six or eight months, and I think there is every reason to believe there will be a heavy business done in 1889.

John S. Leng's Son & Co. (Iron and Steel, Seamless Cold Drawn Steel Tubes, Valves, Syphon Pumps, etc.), New York, write us:

We note a substantial increase in our steel tube business during the year, due, however, to an increased number of consumers of the article, orders from old customers being less than in 1887.

The important new feature in our business has been in carrying the tubes in stock, a convenience highly appreciated by our friends.

The New Doty Manufacturing Co. (Punching and Shearing Machines), Janesville, Wis., write us:

We can say that our business for 1888 has been much larger than for any preceding year, and that, at present, we are full of work, and behind on our orders. We have more than we can attend to without working overtime. For three years we have run without a stop, working full time. During the last year we have brought out a number of new machines that are meeting with good success. During the past two years we have received many orders from the Eastern States, and our tools seem to give good satisfaction in some of the best shops. We anticipate a good business for the coming year, as every indication points that way.

The Holly Manufacturing Co. (Builders of the Holly System of Water Works, and Manufacturers of the Gaskill Pumping Engines), Lockport, N. Y., write us:

The business of the Holly Manufacturing Company during the year 1888 has been greater than ever before in the history of the concern. During the year the facilities for transacting business have been greatly increased, both by the construction of new shops and the addition of many new and heavy tools.

The prospect for business during the year 1889 is very bright, and the company have on hand sufficient orders to ensure them a full year's business.

The Sterling Emery Wheel Co. (Emery and Corundum Wheels, Emery and Emery Machinery of all kinds), New York, write us:

Up to this time we have not closely compared the amount of business done in 1888 by our company with the amount done in 1887, but we think we can safely say that it will show an increase of 20 or 25 per cent. over 1887. During the months of October and November there was an apparent decrease in the number of orders received, both by mail and through our salesmen, which cut down the amount of our sales somewhat, but the *increase* in December, in the number of mail orders, has been very perceptible, and we are happy to state that we have more unfilled orders on our books at the present time than ever before—most of which were unsolicited—and inquiries are coming in very fast now as well. The cost of our labor remains about the same as in 1887. Our production has been about 30 or 35 per cent. larger in 1888 than the year before.

From the information that we have received during the past four weeks, we feel certain that the year 1889 will open with a largely increased demand for our goods, and we have no doubt whatever but that it will be a very prosperous year for our company.

We have made a slight enlargement in one of our factory buildings during the year, and have also opened an office in Chicago, and on May 1st, 1888, we changed the location of our New York store to the present number, and more than doubled our stock of wheels and machinery, and at once noticed an increase in the amount of our local trade, for we are now able to fill most orders at sight from the large assortment of both emery and corundum wheels that we have on hand. The prices of our goods remain about the same as last year.

The E. Horton & Son Company (The Horton Lathe Chuck), Windsor Locks, Conn., write us:

Our business for the past year has averaged fully with the two or three previous years; there seems to be a marked improvement for the last two months, and, as it seems to us now, the prospects for good business the coming year are bright.

We have increased our capacity somewhat during the past year, and have added several new sizes and styles of chucks to our list, and are prepared to furnish anything in the shape of a lathe chuck at short notice.

W. P. Davis (Upright Drills and Slotting Machines), North Bloomfield, N. Y., writes us:

Business has been fairly good the past year, and have turned out and sold as many of our special machines as in any previous year. We have not brought out any new machines the past year, but expect to build a very large machine the coming year, especially adapted for heavy key-seating. We find, since we have made a push on key-seating machinery, many have learned the value of such special machinery, and the demand is increasing, and we have now a call for special heavy machines, suitable for cutting keyways in large gears, propeller wheels, etc., etc., and expect to bring out such a machine the coming season. There is a large field in this direction; but mechanics, as a rule, have to be educated up to the point that it is really advisable to have special tools for such work, instead of using a "makeshift" arrangement, as is used in many shops at the present day.

We are to open a salesroom and office at Nos. 169 & 171 Mill street, Rochester, N. Y., next month, and shall keep a full line of machinists' tools, engines and boilers. This will give us better shipping facilities, and ship more promptly. We shall run our foundry and machine tool works at North Bloomfield as usual. We are running full time (10 hours) and full complement of workmen, and expect to continue the coming year. We have made a trip within past month both East and West, and find everything looking well for a good year's business, and also find there is already a demand springing up that is felt especially by the larger dealers in machinery. We have made several minor improvements in the manufacture of our tools, but nothing of importance.

J. A. Fay & Co. (Wood-Working Machinery), Cincinnati, Ohio, write us:

Shipments for 1888 up to August 1st were larger than in 1887 to the same date. The year 1887 was one of the largest in our experience. Since August 1st of this year there has been a decided falling off in orders. Apparently, those desiring to invest in new enterprises, and new manufacturing interests, preferred to wait until they could know exactly on what basis business was to be conducted. At least, with us, the inquiries from new interests almost ceased. This continued until the latter part of November, when our inquiries and orders commenced coming in again, and we are now receiving a large number of orders from new undertakings. The price of labor remains the same as last year. Raw material is a trifle less, and the price for finished goods during the latter portion of the year has been declining.

We are still introducing new and improved iron-working tools, replacing machines that have become worn and out of date. During the year we have purchased twelve machines, many of them very heavy, rapid and automatic in their movements. We still have quite a number of large unfilled orders on our books. We believe the prospects for trade in 1889 are very fair, and we think that the demand will be sufficient to make up for the loss of business during the present year.

The Standard Tool Co. (Machinists' Fine Tools, Try Squares, Steel Rules, etc.), Athol, Mass., write us:

Our business has had a steady growth throughout the year, and promises a large increase the coming year. We have recently made arrangements with the Athol Machine Co. to handle our entire production, an arrangement that can but prove satisfactory to our many customers as well as to ourselves, and we bespeak for them largely increased sales.

Currier & Snyder (Upright Drilling Machines), Worcester, Mass., write us:

The past year we have done about one-third more business than in any previous year. We have added one of Brainard's 24" full automatic gear-cutting machines, besides many small tools; have also added more new drills to our list. The outlook for this year is very encouraging. We are expecting to enlarge our shop by adding more tools in the near future.

Sibley & Ware (Iron Founders and Machinists, Drills, Pulleys, etc.), South Bend, Ind., write us:

Our business for 1888 has been very satisfactory. There has been a large demand for 20-inch drills, and our general machine and foundry business has been very good. We have taken out two patents on a wood pulley with cast-iron hubs and wrought-iron arms, made whole or split, adapted to any kind of motion, but are very successful under high speeds. We expect to put them on the market during this year, and add largely to our capacity in other ways.

The Pulsometer Steam Pump Co., New York, write us:

It is with pleasure that we can report a larger sale and demand for the new pulsometers for the past year than any year heretofore, and are at times unable to fulfill our orders as promptly as we would desire.

We have increased our facilities, and hope to be able to fill all orders promptly the coming year.

The National Machinery Co. (Specialists in Bolt and Nut Machinery), Tiffin, Ohio, write us:

Our business for the past year has been exceedingly satisfactory; we have kept our full force at work steady, and even run considerable overtime. The prospects for the present year seem fairly encouraging; while we do not expect a boom, we expect a steady demand for our tools. We notice quite a difference in inquiries since the election, pointing to a more settled and hopeful feeling among the manufacturers.

The Athol Machine Co. (Iron Founders and Manufacturers of Hardware Specialties, Meat Cutters, Vises, etc.), Athol, Mass., write us:

Our sales the past year have been about 20 per cent. in excess of 1887, and we consider the outlook for the coming year most excellent.

We have recently arranged to handle the entire production of the Standard Tool Co., manufacturers of fine tools, in connection with our own line, and are now issuing a new combined catalogue of both—a move which we trust our customers will find to their advantage as well as our own.

The Hoppes Manufacturing Co. (Feed-Water Heaters and Purifiers), Springfield, Ohio, write us:

We are glad to report a rapidly increasing demand for our feed-water purifier. Business has been especially good for the last two months, as we have placed enough orders on our books since the middle of November to keep us busy far into the coming year. We have recently added the manufacture of an exhaust steam feed-water heater to our business, that is meeting with excellent success as a heater and mud collector. Our business prospect for next season is exceptionally good. We intend to enlarge our plant in the early spring to more than double its present capacity.

The Fitchburg Machine Works (Metal-Working Machinery), Fitchburg, Mass., write us:

Our business for the past year has been very satisfactory; we have been running up to our full capacity, most of the time on orders; indeed, we have not been able to carry our usual amount of completed tools in stock, for want of time to build them.

We have made no material change in our patterns for the past year, except in our planers. As we wrote you one year ago, we were rebuilding and improving our planers, we now have them all completed except two or three of the largest size. The demand for these planers proves that our customers are well pleased with them.

Prices have been a trifle better than in 1887, but the margin for profit is still very small. We hope that prices will improve in the coming year.

The Energy Manufacturing Co. (Elevators, Hoisting Machinery, etc.), Philadelphia, Pa., write us:

Speaking of our line of manufactures, we have made a number of improvements in our hoists, besides adding machines of heavier capacity. As the volume of our business increases, it is our intention to add still heavier machines to our production. The numerous testimonial letters we are daily receiving warrant us in saying that our hoists and tools have no superior in the market. These machines, together with our center grinder and drill guide, are meeting with sound recognition over this and other countries, and are looked upon as standard goods. Our business for the past year has been beyond expectations. We are pleased to be able to say our shipments were largely in excess over the previous year, oftentimes being so crowded with orders as to occasion the engagement of additional help in their execution. As is the experience of most all manufacturing establishments during the holiday season, we have not been as busy during the past month as we were prior to Dec. 1st; still we have no reason to complain. During the past week we have noticed a marked improvement, and, judging from the numerous inquiries we have receivedand are now receiving, we can say with all frankness that the prospects for the coming year with us are very bright and encouraging.

The Buckeye Engine Co. (Steam Engines, etc.), Salem, Ohio, write us:

Our business for the year just expiring has been quite fair, especially so when it is taken into consideration that this has been presidential year, as that is always considered an off year in our line.

Judging from inquiries received during the last month or six weeks, future prospects look quite flattering, and shall be disappointed if the year 1889 does not exceed in volume of business any preceding year; labor and material but little changed from last year. With the increased business prospectively, we have increased our plant by adding a three-story building to the same—size 50 by 100 feet—and have purchased some new tools during the year, and exchanged some we had on hand for the latest improved ones, in view of keeping up with our neighbors, and promptly meeting the wants of parties in need of motive power.

Stearns Manufacturing Co. (Saw Mill Machinery, Engines and Boilers), Erie, Penn., write us:

We are much pleased to say that our business outlook for the immediate future is very promising. We are now fairly established in our new shops, and find that the increased facilities for handling work has resulted in quite an increased output from the same tools as were in our old plant. It may strike you oddly that our annual reply to your circular letter should always bear a rosy tint, but it is perhaps found in the fact that our orders for spring business, in the saw mill line, crowd upon us at this season of the year, under expectation of being completed upon the opening of facilities for handling logs in the water. We have this year added no new machinery to our catalogue, but have adopted various minor improvements in our existing list, that enables us to maintain our position in the trade. The removal of the works, accomplished within two weeks during the rainy month of October, was quite a strain upon all our energies; and the preparation of the buildings, before and since, has afforded sufficient occupation for all hands.

While not overcrowded with orders in all departments, we have such abundant inquiry for our goods as leads us to anticipate a better year for 1889 than even the good year of 1888.

Williams, White & Co. (Forming and Forging Machines, Drop Hammers, Punch and Shears, Spring Power Hammers, Special Machinery, Eye Bolt Machines, Machinists and Founders), Moline, Ill., write us:

We can report a good trade in our specialties, and have added some new machines this past year; two lathes, one planer, and have put in a larger engine, built a boiler house (of brick). The outlook for the next year is good apparently, but must confess we don't like the look of the market for railway securities. The business of the country hinges more upon the prosperity of the railways than most people imagine, it appears to us.

James H. Wells (Shafting Straighteners, Engineers' and Blacksmiths' Tools and Supplies, and General Repairing), Tampa, Fla., writes us:

My business was good the first half of the year, but owing to a few cases of yellow (?) fever and outrageous quarantines, all business has been paralyzed for four months.

I have sent straighteners to different sections of this country and to Nova Scotia, and they are duly appreciated.

I have lately bought a 28″ planer, 16″ engine lathe, milling machine, 4″ pipe machine and a lot of small tools, and more general supplies than ever before. Tampa is growing rapidly, and I expect to increase my business the coming year. I believe that this part of the country has a future, and I am here to stay.

Union Stone Company (Emery and Corundum Wheels, Grinding, Polishing, Plating Machinery and Supplies, Machine Shop Specialties, and Automatic Grease Extractors), Boston, Mass., write us:

We have not much to give you for publication as regards our business condition in the past year, except that we have been quite busy, and the latter part of the year our orders have increased materially.

Our business in large, heavy machinery and emery wheels is nearly double that of any previous year. The addition of several improved machines, and the purchase of Shoemaker's patents in center and traverse grinders, has given us quite a little extra business; also our automatic grease and oil extractor is beginning to be put into the market, and in the past month or so the orders have come in much faster than we can supply them. The wages of our men remain about the same as last year, excepting we have made a change in our apprentice schedule, giving them an increase each year, which has never been done before, and which we find works very satisfactorily. The last two years we have given our men a half holiday every Saturday afternoon, which we find has very good results. Prospects for business of 1889, in our line, never were better.

Watson & Stillman (Hydraulic Machinery), New York, write us:

We have during the last year very much improved our plant by introduction of new tools of different kinds, electric light, and conveniences for handling the heavier work which has been coming to us. We have exceeded in amount any previous year's business, and at the present time have more work in hand than at same time last year, and anticipate being compelled to put in at an early day a few more tools. We have added quite a number of special tools in our line of manufacture to our lists, and hope at an early date to get out a full new line of lists.

P. Blaisdell & Co. (Drill Presses and First-Class Machinists' Tools), Worcester, Mass., write us:

Our business has been very good this year; have sold a larger number of machinists' tools than we anticipated; usually our business is rather quiet during a presidential year. The outlook for the coming year is unusually good. Prices rule low.

Warner & Swasey (Machine Tools and Special Machinery), Cleveland, O., write us:

Our sales for the past year have exceeded those of any previous year, which has required an increase in our facilities, to enable us to fill our orders. Screw machines have become a very important part of our business, and we find our sales of them are increasing very rapidly.

The horizontal boring machine, which was illustrated in your paper on the 3d of November, was put on the market during the past year. We have received many orders for them, and they are giving excellent satisfaction.

In the line of brass-working machinery, we have been extremely busy, having had several plants to equip with all the machinery, tools, and fixtures for the manufacture of globe valves and other brass goods.

The indications for the coming year are of the most progressive kind, and it seems to us that the machinery manufacturers will have an excellent business.

The D. E. Whiton Machine Co. (Gear Cutters, Centering Machines, Lathe and Drill Chucks, etc.), New London, Conn., write us:

The volume of our business for 1888 shows a slight decrease as compared with 1887, which we attribute to the depression of the summer months, and to the excitement of the campaign. It has been a year of marked improvement in our processes, however, and we are feeling very confident for the future. We are in much better shape for prompt execution of orders than ever before, and on this account we are not carrying as large a number of unfilled orders on our books at this time as we have been compelled to carry at previous periods. This, however, is a more desirable state of affairs for our patrons, and one which we think they appreciate. Our new "Independent" chuck, and our "Pequot" drill chuck, which we have been introducing, have met with the unqualified approval of consumers, and their sales have steadily increased. In machinery, we have not produced anything new during the year, but have lately been making some new patterns for our centering machines, and have a number of plans for 1889 under consideration.

Altogether, we are reasonably well satisfied with the year, and are looking forward to a good business during 1889.

Sterling Elliott (Stitching and Tying Machines, Cutting-off Machines, Indexing Machines, Tap Drill Gauges, Drill Presses, Cycles), Newton, Mass., writes us:

The past year has been in many respects the most satisfactory we have ever known. There have been several reasons for this, not the least of which was our new catalogue, which has not only brought us much trade, but it has come from desirable sources. In getting up this book, we "builded better than we knew." It is a hit. It has been favorably noticed by 78 papers and magazines, and we have received over 1,900 letters, asking for copies of it. We think we can claim the "record" for a machinery catalogue, judging by the number of kind words which have been said of it. Six different papers have each devoted over 500 lines of space to reviewing it. We have orders on hand which will keep us busy until May, with a prospect of a lively trade for next spring.

The Buffalo Forge Co. (Forges, Blowers, Exhausters, Steam Fans and Heaters, Punches, Shears, Drilling Machines and General Hardware), Buffalo, N. Y., write us:

The volume of our business for 1888 has been very large and at the present writing orders in hand make it difficult for us to see how we can spare the time for our customary "shut down" for inventory and repairs.

The well-known "Buffalo" forges, blowers and blacksmith drills seem to be in greater demand than ever, and we have been obliged, in order to accommodate our increased business in this line, to add to our former facilities a new building 60 x 125. This, with an improvement in shop routine, which gives us a more perfect system of "assembling" and closer and more systematic inspection, will enable us to meet the increased demand with our customary promptitude. There are no material changes in the rates of labor here.

We have during the year completed several new designs in power blowers and exhaust fans, which we show in our new catalogue, just issued.

In our hot blast, heating, and ventilating branches we are crowded with work—contracts now in hand being sufficient to keep us employed for four months to come. This seems destined to become a leading branch of our business.

Judging by the current volume of inquiries in all our lines, and with all fear of a radical change in the existing tariff laws allayed, the outlook for 1889 from our point of view is very encouraging.

The Ferracute Machine Company (Presses, Dies and other Sheet Metal Tools), Bridgeton, N. J., write us:

We have had a fairly good year, with a somewhat larger volume of business than ever before, although we have not been able to get as good prices as we would like. This is partly on account of having increased the weight and quality of our products by constant improvements in design, without seeing our way clear to raise the prices in proportion. These improvements will, however, tell in the long run, as we are getting the manufacture of our punching, cutting and drawing presses down to a system, by uniformity of design and the use of special tools, which will enable us to produce them in future more quickly and at a better profit.

Among the other improvements of our plant during the year is a side-track from the Penna. railroad, running into our works, with a ten-ton power jib-crane for loading goods directly on to the cars; also a small yard railroad of our own, running from this crane over a ten-ton platform scale into a new high-ceiling erecting shop which we have just built. For this shop we are making a ten-ton traveling crane, with power appliances for hoisting and traversing in all directions. Beneath a part of its field of travel we are putting our large lathes, planers, etc., and a milling machine, yclept "Jumbo," which we are building from our own designs, and which we believe is the largest in the United States. We are now equipping our shops, offices, etc., with an insolated incandescent electric lighting plant.

Among the actual improvements to our line of presses during the year are a complete re-designing of our heavy punching presses, with an improved automatic clutch adjustable to various speeds, and various loadings of the shaft with attachments, etc. Also convenient methods for cheaply varying strokes and adjustments to order on presses already built, room for much greater height to dies, etc. We have also built several heavy double-crank column presses for working ½″ sheet steel into spring plates, stake pockets, etc., for freight cars and for other heavy railroad work. We are now designing a new drawing press, which will have much greater capacity and more conveniences than the former ones built. Among special machines built during the year have been quite a number of automatic solder dippers and squeezers for petroleum can work, automatic pill presses for druggists' compressed tablets, and some experimental nail machines for making the "Perkins" nail from tin scrap. This latter machine, in its standard form, is nearly ready for the market, and seems to attract a great deal of interest from its novelty and from the fact that it produces a more perfect nail than a cut-nail, from material which can be bought for almost nothing.

Coffin & Leighton (Machinists' Improved Steel Scales), Syracuse, N. Y., write us:

Our business for the last year shows a marked improvement over that of the previous one.

We have been obliged to increase our capacity to keep pace with our orders. We are much pleased with the prospects for 1889.

The L. W. Pond Machine Company (Machinists' Tools), Worcester, Mass., write us:

We are pleased to say the year 1888 has been better than we anticipated at the commencement of the year. There has been a steadily increasing demand for our improved iron-working planers, particularly of the larger class.

Our patented feed and reversing motion have recommended our planers to the favorable consideration of the mechanical public, who seem to appreciate the merits of these and other improvements.

We have, during the past year, increased our facilities for doing large work, by putting in operation several new tools of our own construction, particularly one of the largest planers in the country, and are now prepared to fill orders for the largest class of improved iron planers. We have also designed and successfully put upon the market, a short, wide planer of medium weight and price, particularly designed to meet a long felt want of cotton, woolen and wood-working machine makers, and of printing press, boiler and safe makers, and all kinds of short, wide work, with a moderate expenditure of money and power.

We expect the year 1889 will be a prosperous one.

Henderson Bros. (Patent Exhaust Tumbling Barrels, and Tumbling Barrels of all Kinds), Waterbury, Conn., write us:

We feel some diffidence about writing you of our business progress during the past year, but we can say that it was very satisfactory. The demand for our patent exhaust tumbling barrels was much greater than in any previous year; and, although prices were greatly reduced, we were able, owing to our long experience and our perfect facilities, to make a fair profit.

The new year opens with great promise of increasing business.

L. S. Starrett (Improved Fine Tools for Mechanics), Athol, Mass., writes us:

The demand for my tools continues to steadily increase. The past year has been a successful one, sales being nearly 25 per cent. more than in 1887, and the prospect for the coming year is encouraging.

I have recently built an addition to my factory, giving room for several more men, and have put in more machinery to increase my manufacturing facilities.

To my former list of tools I have added a line of improved extension leg dividers. I have also perfected, and shall soon put upon the market a new micrometer caliper, with improvements that will be appreciated by all using such tools.

In regard to wages, I am paying about the same average as a year or two past, but instead of paying off monthly, as has been my custom, I have adopted the weekly system which I believe more just to employes.

C. F. Baker (Common-Sense Oil Filters and Boiler Cleaners), Minneapolis, Minn., writes us:

In reply to your inquiry, will say: The year 1888 has been, on the whole, a prosperous one for my business. It has been, however, badly delayed by the shutting down and ultimate failure of the glass works here, and by the strikes and lockouts East. Between them I was kept out of glass for some time, and was obliged to stop most of my advertising, and hold many orders over. I am now having glass made by one of the largest firms in the United States, and can depend on getting a much better quality. I have made some improvements whereby the glass is better protected from accident, and the capacity of the filter materially increased.

The principle of making the gravities of the oil and of the impurities to operate in different directions, has shown itself in the quality of work done, and in connection with the visible operation and perfect convenience, has convinced my patrons of its utmost superiority, and its ability to filter oil suitable for the most delicate as well as heavy and costly machinery. Dynamos make the most use of the filter, and high-speed and large engines come next, then air compressors, etc.

My position as chief engineer for C. A. Pillsbury & Co., and the growing filter business, have made it necessary to secure a careful business manager. The prospects for 1889 are very flattering indeed.

The M. C. Bullock Manufacturing Company (Manufacturers of Corliss Engines, Band Friction Hoisting Machinery, Diamond Pointed Rock Drills and General Mining Machinery), write us:

We have had a busy year, working overtime on several occasions for months at a time, and then have had to refuse orders because we could not fill them in the time specified.

We have increased our facilities by adding lathes, planers, cranes, etc. We have also added a large Putnam Machine Co's. slotter, fitted with their patent relief motion to prevent dragging the edge of tool over the work on the upward stroke. It is a *splendid tool*.

We have completed and put on the market a full line of (Lane's patent) band friction portable hoisting machines, covering a range of drums from two feet to six feet in diameter, and a full line of standard (Lane) drums, from three to eight feet in diameter. We have also built a number of large first motion and geared hoists, for coal, iron and copper mines.

We have perfected and put on the market our improved Corliss engine, which is meeting with great success; among our present orders is one for the city of Chicago, and a 32 x 60″ for the Pullman Palace Car Co.

We have also brought out our new hand-power diamond drill, the "Bravo," intended to be used in prospecting in the mountains or other places inaccessible to steam or power drills. It is so light and portable that it can be packed and carried on men's backs to points where even a pack mule cannot go. We have also added a light and portable power prospecting core drill, the "Crescent," a machine thoroughly well built, but lighter and cheaper than any machine of same power that has ever been offered in the market. We have also perfected and brought out our medium weight diamond prospecting core drill, the "Dauntless," which has fairly jumped into public favor, having already made some of the most successful borings ever made by a diamond drill. We have also designed, built and shipped one of our "Giant" diamond drills, with a complete outfit to bore holes to a depth of 3,000 feet, taking out a core the entire depth, to the British Government of Australia. This is the most complete and powerful drill ever built in this country or Europe, and competent mining engineers pronounce it the most perfect piece of mechanism ever built for deep hole prospecting. The fact that this is the fifteenth Bullock drill bought and operated by the Victorian government, speaks volumes for the excellence of our machine both in design and workmanship.

We take pleasure in crediting the AMERICAN MACHINIST with *many* inquiries which we can trace directly to our advertisement in your valuable paper.

We continue, this week, letters from prominent builders and sellers of machinery. Our readers will form their own opinions from the tenor of these letters. We place them as the best index of which we know of the present condition of trade in the country.

AMERICAN MACHINIST

To prevent delays all Communications should be addressed to the Company.

PUBLISHED WEEKLY
BY
American Machinist Publishing Co
96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, FRED J. MILLER, } Associates.

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

Subscription.

$2.50 a year in advance, postage prepaid in the United States, Canada and Mexico.
$3.50 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY
The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R.I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

NEW YORK, JANUARY 10, 1889.

CONTENTS.

	PAGE
16-Inch Engine Lathe	1
Self-Instruction for Young Mechanics. By Frank Richards	1, 2
Modern Locomotive Construction. By J. G. A. Meyer	2, 3
Commutator Bars by Drop Forging	3
Ships in Course of Construction at Wm. Cramp & Son's, Philadelphia	3
Locomotives Built at the Baldwin Locomotive Works	3
Making Corliss Engine Cylinder Patterns. By P. S. Dingey	4
Letters from Practical Men: Piece-Work. By C. Godfrey Whitaker—"Elastic" Rules. By W. S. Rogers—System in the Drawing Room. By F. A. H	4, 5
Condition and Prospects of the Machinery Business	5, 6, 7
Cheap Fuel Again	8
Mechanics' Associations	8
Perpetual Motion in the Patent Office	8
Questions and Answers	8, 9
Manufactures	9
Machinists' Supplies and Iron	10

Cheap Fuel Again.

We understand that a company is now engaged in putting in a plant at Defiance, Ohio, to supply that city with gas for heating and lighting. This gas is to be made by a new process known as the Proctor process. In the contract the company guarantee to supply the city and citizens with illuminating and heating gas (of not less than fourteen candle-power) at a price not exceeding five cents per thousand cubic feet, with the understanding that Ohio crude oil is to be delivered at the works at a cost not exceeding fifty cents per barrel.

There is nothing unreasonable in the belief that a gas suitable for the purpose can be made at a profit for the price named, provided the crude oil can be had cheaply enough. But it is becoming daily more and more plain, that the numerous oil wells of Ohio were not so much a gift by the Creator to the people of Ohio generally, as to a few of the citizens of Ohio living on Euclid avenue, Cleveland, and styling themselves the Standard Oil Company.

It has been shown repeatedly that these gentlemen propose to do the bulk of the business in oil and its products. We very much doubt if the company which is operating at Defiance will be able to get crude oil at such a price as will enable them to continue the service at five cents per thousand feet. And when the cost of crude oil rises at Defiance, and the cost of the gas is therefore necessarily, though, of course, very reluctantly raised, it would be interesting to know just how much of the stock of the company holding the franchise at Defiance is owned by the aforesaid gentlemen on Euclid avenue.

It should always be remembered that the franchise for laying pipes in the streets of a city for the purpose of supplying gas is valuable, and should be granted to no one without fully securing the interests of the citizens. How their interests are to be secured by a contract to deliver gas at a price dependent upon the price of crude oil delivered at the works, we cannot see.

It would not at all surprise us if, some day, it would be discovered by the citizens of Defiance that the gentlemen living on Euclid avenue own a franchise in their town worth thousands of dollars, which they have secured in return for obligating themselves to deliver gas at a certain price, *provided* they don't charge themselves too high a price for crude oil.

At Springfield the same company is trying to obtain a franchise. Three different companies have tried to obtain the privilege of laying pipes in the streets of that city within the past year or two, and in the case of two of them, good reasons were discovered for believing that the Standard Oil monopoly was at their backs. The Euclid avenue gentlemen propose to see that people do not enjoy the gifts of nature upon too low terms, so long as those gifts can in any way interfere with their business, and that fact may as well be understood, and also the additional fact, that what they propose to do they will do, until the people awake to the fact that they have rights in these matters, which at one time were clearly recognized, but have simply become obscured by gradual encroachments.

Mechanics' Associations.

There have been some movements of mechanics of late years in the direction of forming educational associations or societies, but such movements have been quite too few. The most noticeable of these movements has been in the instance of the stationary engineers, who, to the number of several thousand, are engaged in educational work that has and will show good results. No one who is at all familiar with the inside working of the engineers' associations will deny this.

Besides the engineers, the iron moulders have done something in the way of industrial organization. Their progress will be watched with interest, because, as a body, foundrymen have made great progress during the last ten years in the way of getting better theoretical and practical knowledge of their trade.

But the stationary engineers and the iron moulders are but a small portion of the skilled workmen. There ought to be mechanics' educational societies in every manufacturing town in the country, modeled perhaps something after societies that have a central association, with subordinate branches here and there. While there should be but little machinery in the organization of such associations, and that of the simplest kind, all experience shows that there must be some. Nothing of consequence can be done except it be done decently and in order, and in every association there must be some rules that are inflexible. Men cannot join together for any purpose, and succeed for any length of time, unless there are some fundamental principles that all agree to recognize. On the contrary, more than one promising society has been strangled by too many rules—smothered by machinery, as it were.

A trouble with the skilled workmen of this country, in the way of educating themselves, is a lack of independence in the matter. In all other things they have plenty of independence, but, curiously enough, when it comes to improving themselves in a way to make it possible to rise in the world, they expect someone else to supply the facilities and run the machinery for them. A man prizes what he works hard for, and knowledge that costs something—some self-denial, for instance—to get, is apt to be used to advantage. If mechanics want educational associations, they will have to plan them and support them, neither of which is a job of great difficulty or cost. If it is a matter of importance for mechanical engineers to travel hundreds of miles to discuss and hear discussed, matters pertaining to their business, why should it not be of importance for mechanics to have places for meeting for similar purposes, without the expense of going away from home?

Since writing the foregoing we have received the following, which speaks for itself:

A class in steam engineering is to be started at Wells Memorial, on Tuesday, the 8th of January, which cannot fail to be of interest to steam engineers, firemen and machinists, of which there are several thousand in this city [Boston.]

The instruction is to be in the hands of Prof. Peabody, of the Institute of Technology, and is intended to be of a thorough and practical nature.

The lessons will begin with instruction in the use of the steam engine indicator, and in the calculations and construction pertaining to it, and will include other work relating to the construction and operation of steam engines.

The class will meet at the Wells Memorial Building, 987 Washington street, at 8 P. M. of the second and fourth Tuesdays in the months during the winter.

No charge will be made to members of Wells Memorial Institute, or members of Mass. Society Stationary Engineers, Boston Steam Fitters' Association, Machinery Constructors' or Plumbers' Union (all of whom must produce membership card). All unknown can join on payment of $1 a year. All who are interested can receive full information by applying to the superintendent, who will be pleased to see applicants at the Wells Memorial, or to give information by letter.

Along with the above we received a letter from James Duncan, Secretary of No. 1 of Boston, N. A. S. E. Mr. Duncan writes that he was led to move in the matter of establishing such a class by reading in the AMERICAN MACHINIST of a somewhat similar class in New York.

We are glad to hear of this move in Boston. Those who attend are to be congratulated upon securing the services of one so able to instruct as Professor Peabody.

Perpetual Motion in the Patent Office.

We don't know just what the duties of Chief Clerk Lipscomb, of the Patent Office, may be, but we have no doubt that the practical inventors of the country, and others interested in patented inventions, will join us in the hope that the practical management of the office does not depend to a very great extent upon him, if it is true, as reported in a recent press dispatch, that he has declared perpetual motion to be an "assured fact," and that there are now in the Patent Office "machines which have sufficient power to run themselves from now till doomsday," and that "a machine with surplus power for the running of other machinery will come some day, and may come at any time."

This is enough to stir all the perpetual motion cranks into renewed activity, but is little calculated to inspire practical mechanics and inventors with respect and confidence in the management of an office which has for its chief clerk one so unfamiliar with the fundamental laws of physics, or so easily imposed upon.

The engines of the cruiser Yorktown, built at Cramp's, developed, it is said, more than the contract power of 3,000 horse-power in her preliminary trial trip. Her machinery is said to have worked admirably. According to the terms of the contract, the builders will receive $100 for each horse-power developed in excess of 3,000, and $100 per horse-power will be deducted for each horse-power less than 3,000.

MINERAL RESOURCES OF THE UNITED States, Calendar Year 1887. David T. Day, Chief of Division of Mining, Statistics and Technology, Washington, D. C.

This is the fifth volume of the series, and extends the information contained in previous volumes, to the close of the year 1887. It contains, in a form handy for reference, the amount of the mineral products of the country, location of mines, and much other valuable information. It is a large, bound book of more than 800 pages, and can be had by remitting 50 cents to the Director United States Geological Survey, Washington, D.C.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(13) A. K. J., Omaha, Neb., asks: 1. Is a water tube boiler more economical than a return tubular? *A*—In well-constructed and arranged boilers there should not be much difference. 2. Is 8 lbs. of water per pound of combustible considered good practice with return tubular boilers? *A*.—No; you should get 10 lbs.

(14) J. L., Newark, N. J., asks: 1. Are there any materials that can be used to advantage with babbitt metal for babbitting journals? *A*.—Properly prepared babbitt metal requires nothing to be added to it. 2. By what rule can the area of a circle be found? *A*.—Square the diameter and multiply the product by .7854. See any common school arithmetic.

(15) H. N., ——, writes: I have a main driving belt that has become too slack. It is a 36-inch double endless belt; distance between centers of shaft, 36 ft.; driving pulley, 15 ft. dr.; driven pulley, 4½ ft. dr.; revolutions of engine, 75. Would you advise me to cut a piece out of the belt and lace it, or would you advise the use of a tightener? *A*.—By all means shorten the belt. If you are not so situated that you can shorten it making it endless as now then cut and lace it.

(16) F., Watertown, Mass., asks: What will permanently soften leather excepting oil? *A*.—We do not know of anything besides oil which will do this after the leather is made, though there are methods of tanning and preparing leather by which it is made soft, which, being out of our line, we are not familiar with. 2. Is wood pulp used in the manufacture of wooden articles, and if so, does it result satisfactorily? *A*.—Wood pulp may be used in this way, but we have no knowledge of it.

(17) L. W., ——, Florida, writes: I have a locomotive fire-box boiler of the water bottom style, which has rusted through underneath the fire-box in one or two places (on the outside). I am going to cut out the sheet so as to leave a hole about 2 × 3 or 4 feet. The boiler is made of ¼-inch iron of good quality. I would like to ask you what would be the difference in the strength of the seam if properly put together, with ⅜-inch rivets, or with bolts of same size, such as are usually used for the purpose? *A*.—⅜-inch rivets, or bolts, are too large for ¼-inch iron. It is not possible to tell just what would be the difference in strength as between a riveted and a bolted joint, but we think the riveted joint would be at least 15 per cent. stronger at first, and much less likely to lose strength by use; we should never sanction a bolted joint when it was possible to make one by riveting.

(18) H. B., Passaic, N. J., asks: 1. How can I pack pipes, flanged or threaded, carrying kerosene oil? *A.*—We do not think you will have any trouble with joints made as for water or steam. If so, you could use copper gaskets. 2. How can I make a piston, working slowly, tight against kerosene? *A.*—We should suppose cup leather packing, very commonly used in pumps, would do. 3. In a pipe system containing water, if a pressure is exerted at one end how long before the pressure will be the same at the other end, the distance being 100 feet? *A.*—Water being practically incompressible, we assume that the interval of time would be hardly noticeable. 4. Will air enclosed with kerosene be absorbed? *A.*—Not to any noticeable extent. Under sufficient pressure you could probably force considerable air into the kerosene, but it would most of it find its way out upon removing the pressure.

(19) R. S., Fort Scott, Kansas, asks: 1. In computing the horse-power of an engine, is it proper to assume that the boiler pressure represents the pressure in the cylinder, or should some allowance be made for loss between the boiler and engine? *A.*—There is always a loss between the boiler and engine, otherwise there would be no flow of steam. This loss may be no more than a pound or two, or it may be much more, according to conditions. In estimating the power which a well constructed engine, running non-condensing, ought to develop with steam from 70 to 100 lbs., one-half of the boiler pressure may be taken as the mean effective pressure in the cylinder. This gives a fair margin for governing. There are, undoubtedly, engines running in which the mean effective pressure is greater than this, but there are more in which it is materially less. 2. Are there any schools in which a person can learn to be a practical electrician? *A.*—Most technical schools will give you an opportunity to study in that direction.

(20) W. H. C., Hartford, Ct., writes: I wish to bore a hole 1¼ inches diameter, in a solid piece of cast-iron 7 inches deep. I use three drills, the last one being a turned flat drill 1-64 inch smaller than the reamer. I use one reamer having 12 flutes 6¼ inches long, slightly tapered for one inch at the end. I enter the reamer at slow speed in the lathe and force it in two inches, after which I ream it the balance of the way in the vise. Others think I should ream it all in the vise, for the reason that starting it in the lathe will spoil the reamer. Which is preferable, if either, and why will it spoil a reamer to do as I did? *A.*—We infer from your description that the reamer used was a hand reamer, and in the first place 1-64 inch is altogether too much to ream out with it, .005 inch being plenty. It will not injure a hand reamer to be used in the lathe, provided the speed is very slow, the cut very light, and it is not allowed to leave the back center and get caught; but the trouble with using such reamers in the lathe is that a failure on one or more of these points is liable to occur, and if it does the reamer is very likely to be ruined.

(21) S. D. H., Baton Rouge, La., sends a sketch of two pulleys; one, 4 feet diameter is on an engine shaft, and drives the other, which is 3 feet diameter, by means of a belt. An idler 12 inches diameter is shown pressing upon the belt, and in two different positions; one in which the belt is only slightly deflected from a straight line, and the other in which it has been forced down so as to deflect the belt considerably and make its arc of contact considerably greater. In his letter, he says the idler is forced down with a pressure of 1,000 pounds, and fixed stationary. He wishes to know in which position it does the most work with the same load on the engine and all other conditions remaining the same *A.*—It is not stated whether the idler is on the slack side of the belt or not, and we are not quite sure whether it is meant to inquire in which position the idler does most work, or in which position the belt does most work. The work which the belt will do will be increased (up to the limit of its strength) by increasing its arc of contact, and by forcing the idler down the arc of contact is increased. The idler, of course, does no work, in the strict meaning of the term, but work is done in driving it, which is expended in friction and in fanning the air. The amount expended in friction is increased by increasing the pressure which the belt exerts upon it, and if this pressure remains constantly at 1,000 pounds there will be no difference in the amount of work expended. But if the idler is fixed rigidly in position the pressure upon it will not remain constant, but will increase in a certain proportion to the pull upon that side of the belt, and the amount of deflection of the belt caused by the idler. If the idler is midway between the pulleys, as shown in the sketch, the direct thrust or pressure upon it will bear the same proportion to the pull upon that side of the belt that a line equal to twice the deflection of the belt will bear to half the length of the belt from one pulley to the other, the deflection and length of belt being both measured from the points at which the belt leaves the one and comes in contact with the other pulley, after the idler is in place. The reason for this will be understood from the answer to Question 80, in our issue of Feb. 18, 1888. It is plain from this that more work will be done in driving the idler the greater the deflection caused by it, but only the amount necessary to overcome the increased friction, caused by the increased pressure and the greater bending of the belt. Idlers should be as large in diameter as they conveniently can be, to reduce both the bending and friction.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link Belting.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

The Best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

"Swift" Sight Feed Lubricator; no glass tubes; simple, reliable. Swift Lub'r Co., Elmira, N. Y.

Mechanical drawing and designing taught by correspondence. I. Donald Boyer, Dayton, Ohio.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

"How to Keep Boilers Clean." A 96 page book mailed free by Jas. E. Hotchkiss, 120 Liberty St, N.Y.

Davis Key-Seating Machines kept in stock by Manning Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

Brown & Sharpe Mfg. Co. have a line of machinery with S. A. Smith, 23 S. Canal st., Chicago, Ill.

Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Common sense oil filters are a wonder. They repay cost quickly. C. F. Baker, Minneapolis, Minn.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Engine lathes, hand lathes, fine tools, files and supplies for machinists and other metal workers. Frasse & Co., 92 Park Row, N. Y.

Upright drills, improved, sizes 21", 23", 25", 28" 32", 36" swing; finely made and great capacity. Currier & Snyder, Worcester, Mass.

The economy of Electric Lighting for Factories is found in catalogue of the Waterhouse Electric & Manufacturing Co., Hartford, Conn.

Patents obtained. Patent litigation conducted, R. G. DuBois, Patent Attorney, 928-930 "F" street, Washington, D. C. Correspondence invited.

Send for Descriptive Catalogue of "Roper's Hand Books" for engineers and firemen. Edward Meeks, Publisher, 1012 Walnut street, Philadelphia, Pa.

Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

See illustration of improvements in Hooks for Steam Engines, in Nov. 24 issue. For particulars address T. C. Dill Machine Co., 726 Girard av., Phila. Pa.

Fine tools and supplies for machinists and other metalworkers. Get our prices before purchasing elsewhere. Montgomery & Co., 105 Fulton st., N. Y. City.

Curtis Pressure Regulators. Curtis Return Trap Curtis Damper Regulator. See Jan. 3, p 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

With my System, Exhaust Steam Heating costs nothing for fuel; Live Steam Apparatus altered to Exhaust. Satisfaction guaranteed. Geo. A. Barnard, 15 Cortlandt street, New York.

W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.

Contract work of all kinds executed promptly and on reasonable terms. Parties wishing gray iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.

"Curiosities of the U. S. Patent Office." Just out. Unique, Entertaining, Instructive, Amusing. An Elegant, Illustrated, Cloth-bound book. Price, $1.50. Descriptive pamphlet *free*. Wm. C. Raymond, Publisher, Syracuse, N. Y.

A system of easy lettering, by J. H. Cromwell giving 26 forms of alphabets. The space to be lettered being divided into squares; simple and effective. Price 50 cents. Catalogue of books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.

Special facilities for the manufacturing of all kinds of light machinery, hardware and novelties, by contract or otherwise. Presswork and stamping done on short notice. Estimates furnished. Punches, dies and special tools made when required. Rockaway Mfg. Co., 3 E. 14th street, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

"Practical Drawing" By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including Jan. 3, 1889 issue, 67 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 82 articles have thus far appeared up to and including the Jan. 10, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

The Electric Light Co. of Quincy, Mass., will increase its capital stock.

The Wood Pulp Co., Kokomo, Ind., will double its manufacturing facilities.

The Amoskeag Manufacturing Company, Manchester, N. H., will build a new machine shop.

Nearly 50 per cent. of the rolling mills in New England have gone out of use during the past 10 years.

The Mathews Gas Engine Company has been incorporated, to manufacture gas engines, at Chicago, Ill.

Considerable damage was recently done by fire to the machine shop of A. Garrison & Co., Pittsburgh, Pa.

The shops now being built at East Los Angeles by the Southern Pacific Railway will comprise 15 large brick buildings.

The Oronoka Woolen Mills, Philadelphia, Pa., are erecting new buildings, with the intention of increasing output.

R. W. Emerson expects to build a steam mill for making shingles and other wooden articles, at Pennaquid, Maine.

The Brainerd & Armstrong Co., New London, Conn., are to build a two-story addition to their silk mill in that town.

The Star Mills Company, of Charlotte, N. C., has been incorporated, and will build a roller flour mill of 100 barrels capacity.

There is water-works agitation at Hull, Mo.; Palisades, Dak.; Lake Charles, La.; Grand Junction, Cal.; Sag Harbor, N. Y.; Greeley, Col.

The Dayton (Ohio) Board of Trade is making an effort to raise sufficient money to induce the Davis Sewing Machine Company to build shops there.

A charter has been granted to the H. C. Ball Company of Philadelphia, Penn.; capital, $25,000. The company propose to manufacture worsted yarns.

A charter has been issued to the Altoona (Pa.) Manufacturing Co. The company propose to manufacture engines and boilers, and probably cars.

The Freeman and the Houghton Gingham Mills at North Adams, Mass., have started up their mills since election, and report that a great number of orders are pouring in.

The Union Pipe Mill Company, of Pittsburgh, Pa., capital $25,000, was chartered recently. The stockholders are James J. Brown, B. Brown, R. J. Brown, Joseph Brown and Hugh McElroy.

Charles Greenwood, proprietor of the woolen mill at Corinna, Me., has offered to put up another woolen mill in the same town, under certain conditions, which have not as yet been accepted.

The Rowan Knitting Company, Salisbury, N. C., who were to build a new knitting mill in the spring, will break ground at once. It will be a two-story building, with engine and boiler house adjoining.

The Canadian Pacific Railway Company are building large car shops near Montreal. The company intends to build their own cars, many of which have heretofore been bought in the United States.

The Rathburn Manufacturing Company, Milwaukee, Wis., has been incorporated, with a capital of $100,000, by Francis W. Kimball and others, to manufacture tools and implements for railway construction and operation.

The Tacey Radiator Company has been formed at St. Paul, Minn., with a capital stock of $250,000, for the purpose of manufacturing the Tacey heat radiator and other goods. The incorporators are Thomas M. Husband and others.

The Waterford Knitting Co., Waterford, N. Y., are shutting down, preparatory to making extensive changes and repairs. The capacity of the mill will also be increased by the addition of three sets, thus making a total of eight sets.

The Malcolm Mills Company, Philadelphia, Pa., has been chartered to engage in manufacturing, selling and dyeing threads, yarns, and cotton and woolen goods. C. M. McLeod, G. W. Elkins, C. D. Gill, D. W. Gross and James Wood, incorporators.

Elertson, Bainbridge & Co., Bridgeport, Ct., have sent a representative to Texas, to purchase a large tract of land for the cultivation of flax. Investigations have led them to believe that portions of Harris county are admirably well fitted to produce a good crop.

A new cotton mill is to be built at Chester, Penn. A company has been formed, in which Benjamin Blakeley and W. S. Blakeley are interested, and the mill will be built on the corner of Fourth street and Morton avenue. The plant will have a capacity of 15,000 spindles.

Following is a list of valuable minerals found in Texas, according to E. T. Dunstable, State Geologist: Asphaltum, arsenic, asbestos, barytes, bat guano, copper, coal (including lignite), strontian, sulphate, chalk, diatomaceous earth (tripoli), feldspar, flint, fluor spar, fire clays, gold, millstone grit, whetstone material, graphite, gypsum, glass sand, marls, iron, kaolin and potter's clay, lead, manganese ore, mineral waters, building stones and marble, cement rock, limestone and shells for lime, lithographic stone, ochres, mineral paints, petroleum, natural gas, pyrites, silver, salt, sulphur, soapstone, mica, alum shales, saltpetre and brick clays.

The woolen mill plant at Bolivar, Tenn., operated by J. M. & E. H. Jones, will be moved to Corinth, Miss. The capacity of the mill will be increased and considerable new machinery put in. A building has been secured, which is being put in condition to receive the machinery.

The Sheet Steel and Iron Post Co., of East St. Louis, Ill., incorporated recently with a capital stock of $500,000, proposes to manufacture steel and iron posts for street lamps, telegraph wires, and a variety of purposes. The incorporators are Samuel N. Terry, John P. Keiser, Arthur J. Judge, and Warwick M. Hough.

The Warren Cotton Mills, West Warren, Mass., are to build a large addition to their plant, so as to add about four hundred looms to their No. 1 mill. New boilers will be put in, and a new boiler house built, and new cards, drawing and fly frames, new spinning, and many other improvements are to be made. It will increase the capacity of the concern very largely.

The Aerated Fuel Company, Springfield, Mass., has issued an elaborate catalogue illustrating the use of crude protroleum for forging, welding, tempering, annealing, enameling, brazing, japanning, smelting metals, etc. The catalogue is artistically illustrated, and contains information of value to engineers and mechanics.

The Glenside Woolen Mills, Skaneateles, New York, have been incorporated. The capital stock is fixed at $150,000. C. H. Bruel, T. W. Specht, Lewis Duschmes, of New York City, and George Barrow and James Mitchell, of Skaneateles, are the incorporators. This is the mill that was formerly owned and run by Jas. McLoughlin's Sons, who became financially embarrassed some time ago.

The Westinghouse Machine Co., Pittsburgh, Pa., for the four months ending Nov. 30, 1888, sold an aggregate of 4,070 horse-power of compound engines; 3,990 horse-power of "Standard" engines, and 2,670 horse-power of "Junior" engines. These sales were to actual users. In addition to these were 900 horse-power to agents. During 17 days in December their sales were 47 engines, aggregating 2,345 horse-power.

Edward Keeler, of the Agawam Woolen Company, Springfield, Mass., has been to Kansas City, Mo., with the object of making arrangements for the removal of the plant of the company to that city. The factory gives employment to 400 women. His conditions for removing to Kansas City are that the company be given a bonus of $50,000 in cash, and that Kansas City capitalists subscribe $50,000 in stock to the company, which would be capitalized at $200,000. The plant is valued at $100,000.

Jones & Rogers, Cincinnati, Ohio, have issued what they call their introductory to the trade. They are prepared to furnish drawings to shops that do not keep a corps of draftsmen, and to systematize the manufacture of machines and machinery, and in a brief notice they set forth the advantages of system and order. They do a little something in the line of poetry, and also publish "Chordal's Code," in full, in their introductory. The introductory is well worth writing for.

The following, which we have received, will explain itself: Having severed my connection with the well-known machinery house of E. P. Bullard, with whom I have been 12 years, I have located at the above address [121 Liberty street, New York], where I propose to handle all kinds of iron and brass working machinery, bridge and boiler shop tools, and carry an assortment of first-class second hand machinery. Shall also make a specialty of fitting up shops with shafting hangers and pulleys. Soliciting your favors, I remain, yours respectfully, J. J. McCABE.

The stockholders of the Fall River Iron Works Company, which is controlled by the American Printing Company, Fall River, Mass., held a meeting on the 9th, to consider the question of building new mills. Four new mills are contemplated for the manufacture of print cloth, each with a capacity of 46,500 spindles. These mills are not to be built at once, but put up gradually, and work on the first one will be commenced in the spring. The mills will make cloth for the American Printing Company. Each mill will be 286 feet long and 120 feet wide and four stories high, and the four will form a square. Between these buildings will be the engine and boiler house, and a large chimney.

The Pittsburgh Locomotive Works are very busy at present. They are turning out about ten locomotives a month, most of them being very heavy engines. During a recent visit to the shops we saw in the erecting shop a mogul engine for the Chicago & Calumet Railroad, with cylinders 19 × 28 inches, driving-wheels 59 inches diameter, and a straight boiler 64 inches diameter at smallest ring. The total weight of the engine in working order will be about 120,000 pounds. This is the heaviest mogul engine we have ever seen. The boiler shell is made of ⅝-inch steel. They have lately delivered to the Union Pacific some engines built to the company's drawings and specifications. Among other work recently finished were eight-wheel engines for the L., St. L. & T.; ten-wheelers weighing 113,000 pounds for the St. L., A. & T. H.; and some eight-wheelers for the Vandalia line, the latter to carry 160 pounds' steam pressure.—*National Car & Locomotive Builder.*

Machinists' Supplies and Iron.

NEW YORK, Jan. 5, 1889.

Iron—American Pig.—The demand for next year's deliveries has been fairly good, and some orders have been booked at present quotations. The demand for manufactured iron has not been altogether satisfactory. We quote standard brands, No. 1 X Foundry, $18; No. 2, $17; Grey Forge, $15.50 to $16.

Scotch Pig—The market is dull and unsatisfactory. We quote Coltness, $20.50 to $21; Gartsherrie, $20; Summerlee, $20.50; Eglinton, $19; Dalmellington, $19.50 to $20.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—See bottom of third column, page 11.

Machinist wanted—first job hand capable of managing small shop. J. H. Wells, Tampa, Fla.

Wanted—A brass moulder who can make solid castings. Address B. C., care AMERICAN MACHINIST.

Wanted—A few first-class mechanics. Binghamton Hydraulic Power Company, Binghamton, N. Y.

A mech. draftsman with exp. wants position. New York or vicinity preferred. O. T., AM. MACHINIST.

Wanted by practical machinist, situation in first-class jobbing shop. Address A. J., AM MACHINIST.

Wanted by practical boiler maker, position as foreman; over 20 years' experience; have references. B. M. AMERICAN MACHINIST.

Engineer Wanted—Competent man to take charge of 500 H P. compound engine. Address, stating age and experience, Box 59, AMERICAN MACHINIST.

Position wanted as draftsman; experienced in iron structural, bridge and architectural work; also in general mach'y. Best ref. R. V.; AM. MACHINIST.

Machinist Apprentice—A good opportunity for a few strong boys to thoroughly learn the trade in large machine shop. Apply No. 4 Sheriff st. New York.

Wanted—Position as superintendent of machine shop. Have had experience on steam engine work, steam pumps, locomotive and general machinery work: best references. Address J. C., AM. MACHINIST

A mechanical engineer of 20 years' exp. desires engagement. Had extensive shop and drawing office exp. on general machine work. Is also boiler and engine expert. Address Newbold, care AM. MACHINIST.

Wanted—A young man as assistant draftsman, preference will be given to one having some experience with Corliss Engine details, and a graduate of Stevens, or other similar Institute. Reply, stating age, experience, and salary expected. Address Robert Whitehill, Newburgh, N. Y.

Wanted—A first class machinist as assistant foreman in our shops; only those thoroughly familiar with the manufacture of wood-working machinery need apply. A young man who is smart, energetic and ambitious preferred. A good opening for right man and good prospects for future advancement. Address E. & B. Holmes, 59 Chicago st., Buffalo, N.Y.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Cyclone Steam Flue Cleaner is king, and has no rival. Crescent Mfg. Co., Cleveland, Ohio.

Crescent grease cup for shafting beats them all. Sample free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., consulting engineer for hydr. and pumping machinery, etc.

Punches, dies and special machinery built to order C. F. Langston & Co., 70 N. 4th St., Phila., Pa.

Specifications and drawings for machinery. D. J. Kelsey, M. E., 32 Ins. Bld., New Haven, Ct.

Correspondence solicited with parties having machine or foundry specialties to build. Honesdale Iron Works, Honesdale, Pa.

Bolt cutter for sale—a bargain; cuts ¾ to 1½ in.; complete with taps and dies. Address R. D. Cole Manufacturing Co., Newnan, Ga.

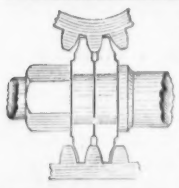
How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati O.

Foreclosure Sale—The valuable Patents on Refrigerating and Ice Machines belonging to W. H. Wood; also drawings and patterns for machines in successful operation, with formula for ammonia gases, etc. Apply Box 54, AMERICAN MACHINIST.

Wanted—Screw Cutting Lathe, either new or second-hand, 22 or 24 inch swing, 8 feet or 10 feet shears, cross feed preferred. Address, with full particulars and photos if possible, J. S. Douglas, 245 So 3d st., Philadelphia, Pa.

"TWENTY YEARS WITH THE INDICATOR." [PRAY.] Vols. 1 and 2 (one volume.) Seventh thousand. Large 8vo, 285 pp., many illustrations. Price $2.50. JOHN WILEY & SONS, 15 Astor Place, New York.



CLOUGH'S PATENT DUPLEX CUTTER

For cutting the teeth of gears; one Cutter cuts a pitch from 18 teeth to a rack inclusive.

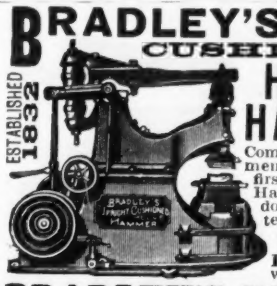
Send for descriptive circular and price list.

R. M. CLOUGH, MERIDEN, CONN.

93 Liberty St., NEW YORK. | 113 Federal St., BOSTON.

IMPROVED PUMPING MACHINERY | For Every Class of Work | Send for New Illustrated CATALOGUE.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER



Combines the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the world.

BRADLEY'S HEATING FORGES.

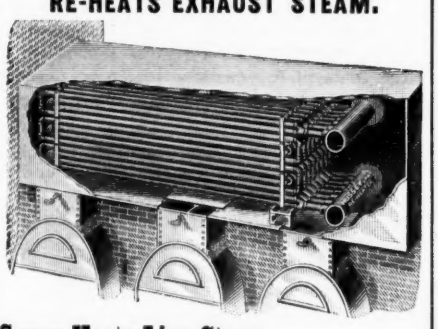
With a manufacturing experience of over half a century, we recommend these machines to be the best, simplest, most durable and combining all the essential elements. For hard coal or coke. Indispensable in all shops that keep Bradley's Cushioned Hammers and men fully employed and reduces cost of production.

Pat. Aug. 30, 1887.

BRADLEY & CO. SYRACUSE, N. Y.

98 Sudbury St., Boston, Mass.
63 Murray St., New York.

THE HUSSEY RE-HEATER
RE-HEATS EXHAUST STEAM.



Super-Heats Live Steam, Heats Air or Water WITHOUT COST.

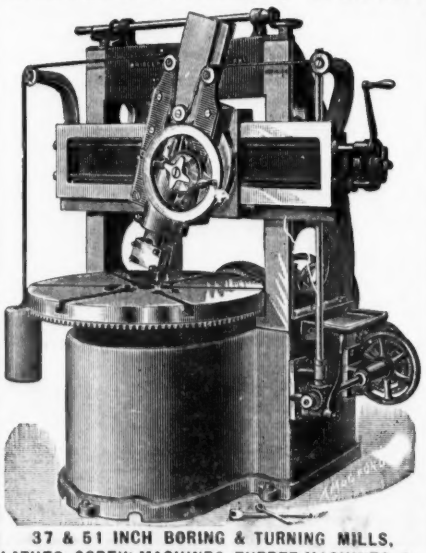
The Hussey Re-Heater and Steam Plant IMPROVEMENT CO.

A. S. HATCH, President. S. D. BREWER, Gen'l Manager. 15 Cortlandt St., N. Y.

FOR SALE, CORLISS ENGINES.

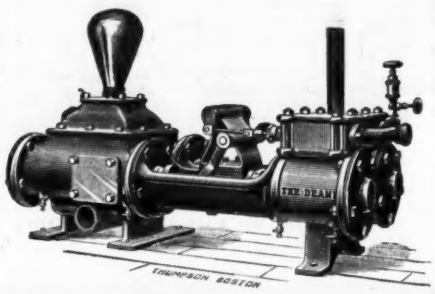
The Fishkill Landing Machine Co., located at Fishkill, on the Hudson, N. Y., offer to manufacturers and others desiring a well built, economical and durable engine, their improved CORLISS ENGINES. They are endorsed by many reputable engineers and persons using them. Address as above.

Bridgeport Machine Tool Works,
E. P. BULLARD, PROP.
BRIDGEPORT, CONN.



37 & 51 INCH BORING & TURNING MILLS, LATHES, SCREW MACHINES, TURRET MACHINES, &c.

ERNEST W. NAYLOR,
CONSULTING ENGINEER, 149 B'way, N. Y.
Designer of hand, steam, power, and hydraulic jib cranes, square shaft, rope, hand and hydraulic traveling cranes. 20 years best English experience.



THE DEANE STEAM PUMP CO.,
HOLYOKE, MASS.,
New York, Boston, Chicago, Philadelphia, St. Louis,
Manufacturers of
STEAM and POWER
PUMPS
FOR ALL PURPOSES.
SEND FOR CATALOGUE.

SIX SPINDLE AUTOMATIC DRILL PRESS.

This Machine is **especially designed** for the use of manufacturers of light hardware. It drills holes to ⅝ inch in diameter. Each spindle is entirely independent, and may be stopped to change or sharpen the drill without stopping the machine or interfering with the other drills. The feed is automatic, can be set to feed any **depth** of hole, and when through its work is released and the drill returns to its place, ready for the operator to change the work and start it again. Address

THE HENDEY MACHINE CO., TORRINGTON, CONN.

IT PAYS TO USE THE BEST.

That is why CRESCENT EXTRA STEEL is found in so many well managed shops where results are closely watched.

For general machine shop tools and dies it is the most satisfactory steel you can get anywhere.

MILLER, METCALF & PARKIN,
CHICAGO, ILLS. PITTSBURGH, PA. NEW YORK, N. Y.

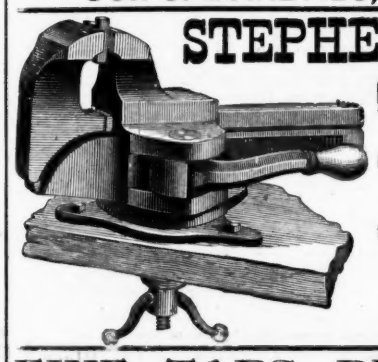
Sebastian, May & Co.'s Improved Screw Cutting FOOT AND POWER LATHES

Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

167 West Second Street, CINCINNATI, O.

OUR SPECIALTIES, 8, 12, 14 and 18 inch Lathes.

STEPHENS' PATENT VISES.



QUICK-ADJUSTING CAM AND TOGGLE JOINT.

Stationary or Patent Swivel Bases.

INCOMPARABLE FOR STRENGTH, DURABILITY FIRM HOLD AND QUICK WORK.

Has improved Taper, Pipe and other attachments. Made in 2, 2¾, 3½, 4½, 5½, and 6½ inch width of jaw.

Sold by the Trade. Send for Circular.

TOWER & LYON, MFR'S,
95 CHAMBERS ST., NEW YORK.

FINE TAPS, DIES, REAMERS, ETC.

LIGHTNING AND GREEN RIVER SCREW PLATES.

Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools. Send for Price List.

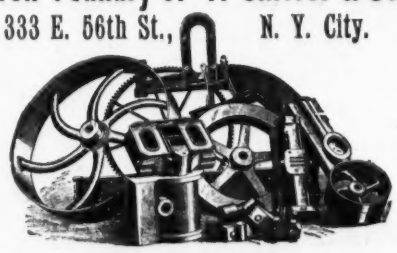
WILEY & RUSSELL MFG. CO., GREENFIELD, MASS.

GUILD & GARRISON, Kent Ave. and South 10th St., Brooklyn, N. Y.

Builders of Steam Pumps, Vacuum Pumps, Vacuum Apparatus, Filter-press Pumps, Air Compressors, Condensers for Pans, Engines, Steam Pumps, Etc.

IRWIN VEEDER,
Expert and Solicitor of Patents.
SIX years' practical experience in shops after receiving a technical education and before entering the practice.
Rooms 309-11, 225 Dearborn Street, Chicago.
J. H. RAYMOND, OF COUNSEL.

Iron Foundry of T. Shriver & Co.,
333 E. 56th St., N. Y. City.



Nice Castings, Smooth and True to Patterns, of very best brands of Pig Iron.
CASTINGS IN QUANTITY AT FAVORABLE PRICES.

TANITE FOR SAW MILLS, FOUNDRIES AND MACHINE SHOPS
EMERY WHEELS and GRINDING MACHINES | For Circulars address
THE TANITE COMPANY, STROUDSBURG, MONROE CO., PA.
Or H. A. ROGERS, 19 John St., N. Y.

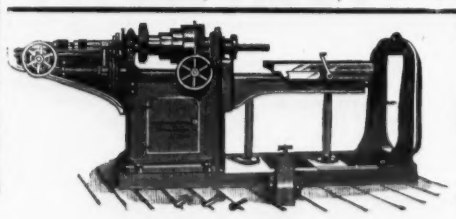
DODGE
Independence Wood Split Pulleys.
COOKE & CO., No. 22 Cortlandt St., NEW YORK.,
Carry a stock equivalent to over 40,000 iron pulleys, lighter and better than iron.

Read the following extract from a letter from one of our customers, referring to these pulleys.

"P. M. BARROW,
"Tanner, Currier and Dealer in all kinds of Rough and Finished Leather.
"Ringtown, Pa., July 19th, 1888.
"COOKE & CO.,
"Gents:—******** They are the best pulleys I ever saw; our stone ran so fast that the grain could not get down, but would fill up the eye in the stone and when full would drop in a quart or two at a time and slip the strap on the line shaft, and threw it off several times. But there was no slip to this. I told my son we would never buy an iron pulley again.
"Yours truly, "P. M. BARROW."

Write for Prices, Mentioning this Paper.

"Star" Foot Lathe Swings 9x25 in. | LATHE | Screw Cutting Automatic Cross Feed, etc.
Scroll Saws, Circular Saws, Lathes Mortisers. | LATHE | Catalogue Free of all our Machinery.
Seneca Falls Mfg. Co. 687 Water St., Seneca Falls, N.Y



BETTS MACHINE COMP'Y,
WILMINGTON, DEL.,
MAKERS OF
Metal-working Machine Tools
OF SUPERIOR QUALITY,
FOR USE IN
MACHINE & RAILWAY SHOPS.

NICHOLSON FILE CO. —SOLE MFRS. OF

FILE CARD.

Files and Rasps

FILE BRUSH.

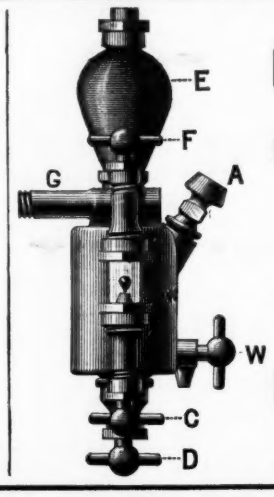
Having the Increment Cut.

The illustrations herewith presented exhibit more convenient and durable forms of **File Cleaners** than are usually found, the majority of those in use being rudely devised and troublesome, and we believe, for this reason, those of our manufacture will find a ready sale. Machinists and others who have not already given them a trial, will find it to their advantage to order the **File Card** and **File Brush** at once.

Manufactory and Office,

PROVIDENCE, R. I., U. S. A.

Steam Pipe.



THE "VOLUNTEER" UP-DROP, SIGHT FEED, LUBRICATOR,

(GATES PATENT.)

FOR STATIONARY ENGINES AND PUMPS OF ALL KINDS. LUBRICATORS FOR SINGLE OR DOUBLE CONNECTION.

PRICE LIST.

Nos.	1	2	3
Price	$10.00	$12.00	$15.00
Capacity	⅓ pt.	½ pt.	¾ pt.

NATHAN MANUFACTURING CO.,

92 & 94 LIBERTY STREET, NEW YORK,

Send for Catalogue. **SOLE MANUFACTURERS.**

HOWE, BROWN & CO., Limited,

ESTABLISHED 1859.
Formerly HUSSEY, HOWE & CO., Limited.
PITTSBURGH, PA.

Manufacturers of all kinds

CRUCIBLE AND OPEN HEARTH STEEL, CAMERON SELF-HARDENING STEEL,

For Shearing Tools and Turning Steel Tires.

BRANCH OFFICES: Boston, 127 Oliver St. New York, 12 Cliff St. Chicago, 171 La Salle St.

Established in 1874.

CLEVELAND TWIST DRILL CO.

Corner Lake & Kirtland Sts., Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

Just Published:

THE

ELEMENTS OF ELECTRIC LIGHTING,

INCLUDING

Electric Generation, Measurement, Storage and Distribution

BY PHILIP ATKINSON, A. M., PH. D.,

Author of Elements of Static Electricity.

260 Pages, 12mo. 104 Illustrations. Price, $1.50.

The most complete and comprehensive treatise on electric lighting ever published, giving the latest practical facts, with the least amount of technicality and mathematical formulæ, with full treatment of the DYNAMO, the STORAGE BATTERY and the principles of DIRECT and ALTERNATE CURRENT lighting.

D. VAN NOSTRAND CO.,

PUBLISHERS,

23 Murray and 27 Warren Sts., New York.

Root's Force Blast Rotary Blower.

FOR

FOUNDRIES, SMITH SHOPS, PNEUMATIC TUBES, VENTILATION, ETC.

SLOW SPEED, POSITIVE BLAST, PERFECTLY BALANCED.

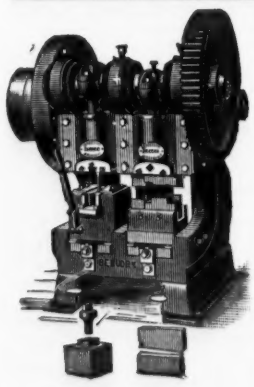
Best Mechanical Construction.

P. H. & F. M. ROOTS, Manufacturers,

CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt. } 22 Cortlandt St.,
COOKE & CO., Selling Agts. } NEW YORK.

In Writing, Please Mention This Paper.



BEAUDRY'S DUPLEX Power Press

COMBINING

PRESS, SHEARS AND PUNCH.

BEAUDRY & CO.

(Formerly of Beaudry's Upright Power Hammer.)

Sole Manufacturers.

Also manufacturers of

HARD COAL HEATING FORGES.

Room 4, MASON B'DG,

70 KILBY ST.,

Boston, Mass.

TO

CIVIL, MECHANICAL & MINING ENGINEERS,

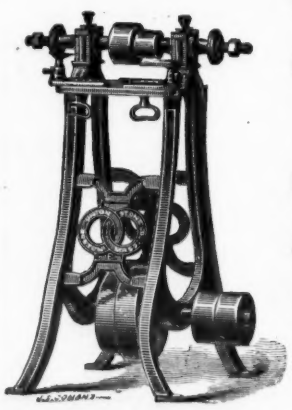
ARCHITECTS, BUILDERS, MANUFACTURERS, &c., &c.

Our COMPLETE CATALOGUE of SCIENTIFIC and INDUSTRIAL WORKS will be sent FREE by Mail on application.

JOHN WILEY & SONS, Astor Place, NEW YORK.

UNION STONE COMPANY,

38 & 40 HAWLEY ST., BOSTON, MASS. 36 JOHN ST., NEW YORK.



EMERY OR CORUNDUM WHEEL GRINDING MACHINERY, EMERY OR CORUNDUM WHEELS AND TOOLS.

MACHINERY FOR POLISHING WHEELS, POLISHING BELTS, AND POLISHING BUFFS, AND ALL SUPPLIES PERTAINING THERETO.

ELECTRO-PLATERS' SUPPLIES.

B. GRINDING MACHINE.

1" Shaft. Takes Wheels to 14" diameter. Countershaft with hangers or in machine. Is specially adapted to light work in machine shop, tool grinding, etc.

PARK MFG. CO.

MANUFACTURERS OF

34 Beach Street, Boston, Mass.

The Park Injector,

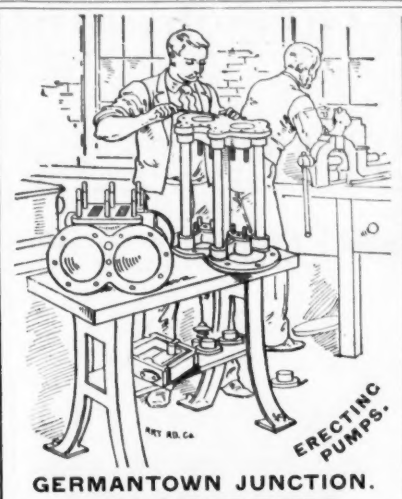
EJECTORS AND JET APPARATUS.

OUR SPECIALTY IS

PLANER VISES AND MEASURING MACHINES.

THE GILKERSON MACHINE WORKS,

HOMER, N. Y.



GERMANTOWN JUNCTION.

PHILADELPHIA

DUPLEX PUMPS ALL SIZES. EVERY SERVICE

BARR PUMPING ENGINE CO

C. W. LE COUNT,

South Norwalk, Conn.

REDUCED PRICE OF LE COUNT'S HEAVY STEEL DOG

No.	Inch.	Price.
1	3-8	$ .40
2	1-2	.50
3	5-8	.60
4	3 4	.60
5	7-8	.70
6	1	.70
7	1 1-8	.80
8	1 1-4	.80
9	1 3-8	.95
10	1 1-2	.95
11	1 3 4	1.10
12	2	1.30
13	2 1-4	1.35
14	2 1-2	1.45
15	3	1.60
16	3 1-2	1.80
17	4	2.10
18	4 1-2	2.75
19	5	3.75
Full set of 19		$23.60
20 (ext.) 5 1-2		4.00
21 (ext.) 6		5.00

This Dog has a Very Heavy Pose, so that if the thread wears a Heavier Screw can be substituted.

Le Count's Heavy Steel Dog.

With Steel Screws, Lathe Made and Hardened. When ordering, state as above, whether a full set or a set of 12, or small set of 8. Users of those dogs prefer them to any other make.

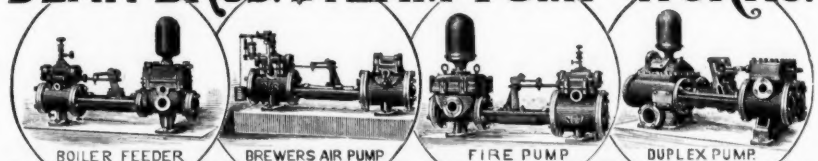
One Small Set of 8—by 1-4 inches to 20 inch, $ 6.25
One Set of 12—by 1-4 in. to 2 in. continued by 1-2 in. to 4 in. 13.25

OUR NEW **CATALOGUE OF TOOLS**

And Supplies sent free to any address on receipt of Ten Cents in stamps (for postage.)

Chas. A. Strelinger & Co., WOOD AVE., Detroit, Mich.

DEAN BROS.' STEAM PUMP WORKS.



PUMPING MACHINERY FOR ALL PURPOSES.

INDIANAPOLIS, IND.

SEND FOR CATALOGUE AND PRICES.

HALL DUPLEX STEAM PUMPS.

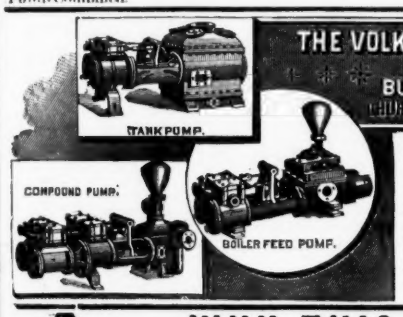
Send for New Catalogue.

Boiler and Pump Combined.

HALL STEAM PUMP CO.,

91 Liberty St., New York.

Fire Pump.



For Sale at Factory Prices by

A. Aller, New York; Walworth Construction and Supply Co., Boston; Henry I. Snell, Philadelphia; Thos. J. Bell & Co., Cincinnati; Shaw, Kendall & Co., Toledo; The George Worthington Co., Cleveland; Goulds & Austin, Chicago; Kennedy & Pierce Machinery Co., Denver, Col.; Sheriff & Ashworth, Pittsburgh, Pa.; Jos. Baur, Manistee, Mich.; Jas. Jenks, Detroit, Wickes Bros., East Saginaw; Adolph Leitelt, Grand Rapids; E. F. Osborne & Co., St. Paul, Minn.; Rundle, Spence & Co., Milwaukee; Joshua Hendy Machine Works, San Francisco; Flynn & Emrich, Baltimore; Forbes, Liddell & Co., Montgomery, Ala; Bailey & Lebby, Charleston, S. C.; Pond Engineering Co., St. Louis and Kansas City; O. B. Goodwin, Norfolk, Va.; Columbus Supply Co., Columbus, O.; C. S. Leeds & Co., Minneapolis; H. D. Coleman, New Orleans.

WHY THIS IS PUT HERE!

For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the

NEW PULSOMETER,

THE CHEAPEST AND BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.

More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.

Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A-1 Testimonials. Mailed Free.

PULSOMETER STEAM PUMP CO., 120 LIBERTY ST., N. Y.

"LITTLE GIANT" IS THE **Best Injector**

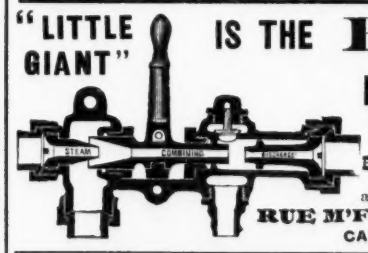
For Feeding all Steam Boilers.

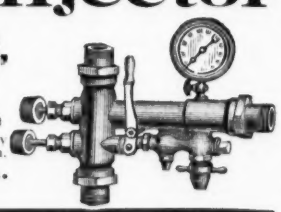
RUE'S ◎ EJECTOR,

Superior to all others for Raising and Forcing Water and other Liquids.

Boiler Washer and Testing Device

Uses Warm Water, avoiding injury and facilitating the Raising of Steam.



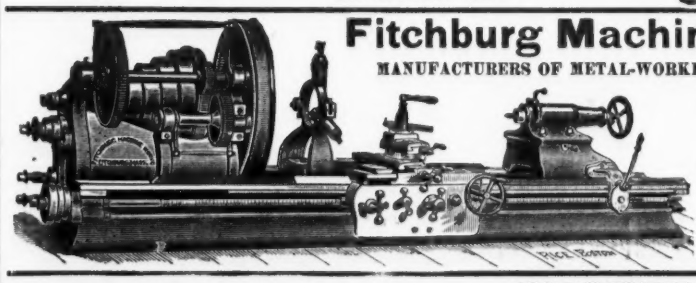


RUE M'F'G CO., PHILA., PA.

CATALOGUES FREE.

Fitchburg Machine Works

MANUFACTURERS OF METAL-WORKING MACHINERY.



OFFICE AND WORKS,

13 to 21

MAIN ST.,

Fitchburg, Mass.

SEND FOR CATALOGUE.

HENRY CAREY BAIRD & CO.,

Industrial Publishers, Booksellers and Importers,

810 Walnut St., Philadelphia.

☞ Our New and Revised Catalogue of Practical and Scientific Books, 80 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

BEST PLANE IN THE WORLD.

The Gage Tool Co.'s Self-Setting Plane.

NEW YORK TRADE SCHOOLS,
68TH STREET AND 1ST AVE.

To GAGE TOOL CO., Vineland, N. J.

DEAR SIRS:—I have used the Planes made by your Company, and like them better than any Plane I have ever used.

Yours Resp'y, JAMES DEKAY,
Manager N. Y. T. Schools.

PHILA., PA., April 5th, '88.

GAGE TOOL CO., Vineland, N. J.

Your Plane is the most perfect Plane I ever used. I have been in the business for 40 years and have never found its equal. I could have sold it for double what I paid for it.

C. R. PALMER, 715 N. Broad St.

ASK DEALERS FOR THEM.

WORTHINGTON

Independent Condenser

ADAPTED TO

STATIONARY AND MARINE ENGINES

SURFACE CONDENSERS

And Vacuum Pans

High Range of Vacuum assured

REGULAR IN MOTION DURABLE AND COMPACT

CORRESPONDENCE DESIRED

HENRY R WORTHINGTON

NEW YORK

BOSTON PHILADELPHIA

CHICAGO ST LOUIS SAN FRANCISCO

A PROFITABLE BUSINESS INVESTMENT for the New Year would be to put in the **safest, most economical,** and **best** steam generating plant obtainable.

When preparing to do this, it will pay you to correspond with

HARRISON SAFETY BOILER WORKS,
Germantown Junction, Philadelphia, Pa.

"STEAM"

A VALUABLE BOOK FOR EVERY STEAM USER AND ENGINEER.

PUBLISHED FOR FREE DISTRIBUTION, BY

THE BABCOCK & WILCOX COMPANY,

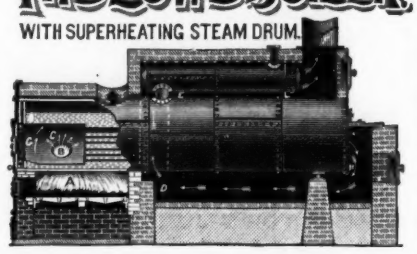
MANUFACTURERS OF

WATER-TUBE BOILERS,

107 Hope St., Glasgow. 30 Cortlandt St., N.Y.

THE LOWE BOILER

WITH SUPERHEATING STEAM DRUM.



Over fifty years' competition has proven this system of boiler to be the best in every respect. The **LOWE BOILER,** with all improvements, is the simplest, best wearing and most economical of any kind of fuel.

Send for description and histories of Steam Boilers and Feed Water Heaters (free) to

BRIDGEPORT BOILER WORKS,
BRIDGEPORT, CONN.

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.

Steam Boilers

FOR ALL PURPOSES,

POND ENGINEERING CO.

SEND FOR CIRCULAR.

W. A. THOMPSON SC.

St. Louis, Mo.

FORGING AND WELDING BY PETROLEUM AIR BLAST FIRES.

THE AERATED FUEL COMPANY,
J. H. BULLARD, GENERAL MANAGER. SPRINGFIELD, MASS.

REPRESENTED BY

W. S. COLLINS, 171 B'way, N. Y. (Suite 24). HARRIS & COWDERY, Ashtabula, Ohio.
ALDEN SPEARE'S SONS & CO., 3 Central Wharf, Boston. I. C. HOWES, Kansas City, Mo.
WILLIAM PICKETT, SON & CO., 170 Lake Street, Chicago, Ill., and St. Louis, Mo.
CHILION JONES, Gananoque, Canada. DUNKIRK ENGINEERING CO., Dunkirk, N.Y.
BRADLEY & COMPANY, Syracuse, N. Y. J. M. DAVIDSON, Columbus, Ohio.
KALAMAZOO SPRING AND AXLE COMPANY, Kalamazoo, Mich.

Brass Melting Furnace.

Patent CALCULATOR, For Engineers.

Mechanical. Marine. Electrical. Mining. Hydraulic. Heating. Sanitary. Military.

Naval Constructors Architects. Builders. Mechanics. Assayers. Chemists. Scientists. Students.

Size 10x3¼x1⅛ in. Complete pocket book. All practical problems solved at sight. Mailed on receipt of 75 cents.

R. C. SMITH, No. 1 Broadway, N. Y.

SEND FOR CATALOGUE.

WORCESTER MACHINE SCREW CO.

Manufacturers of Set, Cap and Machine Screws, Studs, etc.

SIMONDS ROLLING MACHINE CO.,
MANUFACTURERS OF ROLLED FORGED SPECIALTIES,
INCLUDING **STEEL BALLS**

For Anti-Friction Bearings, of Best Cast Steel, Hardened, Ground and Burnished, from 3-16 in. to 2 in. diameter.

In quality and density of metal, in uniformity of temper, and in accuracy and nicety of finish warranted unequaled.

SAMPLES AND PRICES ON APPLICATION.

SIMONDS ROLLING MACHINE CO., Fitchburg, Mass

MACHINE TOOLS.

Special or General, any size, for the manufacture of Ordnance, Locomotive, Marine and Stationary Engines, Ships' Boilers, &c., supplied to many leading Firms in the United States of America.

Asquith's Patent Radial Drills

Unequaled by any in the World. Send specification of requirements. Large Stock of Tools ready for delivery.

W. ASQUITH, HALIFAX, England

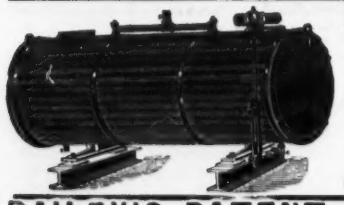
THOS. H. DALLETT & CO.
1305 Buttonwood Street,
PHILADELPHIA, PA.

Portable Drills, Hand Drills, Boiler Shell Drills, Light Drill Presses, Special Machinery.

SEND FOR CATALOGUE.

PECK'S PAT. DROP PRESS.
BEECHER & PECK. NEW HAVEN CONN.

DROP FORGINGS OF IRON OR STEEL
BEECHER & PECK, NEW HAVEN CONN.



The HOPPES Live-Steam Feed-Water Purifier,

Guaranteed to Prevent Scale in Boilers,

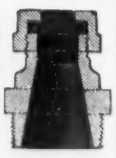
Using any kind of water. Hard Sheet Steel Troughs, *Easily Cleaned.*

HOPPES MANUFACTURING CO.,
Send for Catalogue D. SPRINGFIELD, OHIO.

BAILEY'S PATENT COPPER CAP FUSIBLE PLUG.

A Cheap Means for Preventing Accidents to Steam Boilers through Low Water.

The **fusible metal is kept from contact with the water,** avoiding the chemical and mechanical action, which would otherwise prevent it from melting. Cap is readily removable, permitting free inspection. Highly recommended by the chief Boiler Insurance Companies of Great Britain, over 150,000 being sold in Europe since first introduced, with increasing sales. Also by the U. S. Board of Supervising Inspectors of Vessels at Washington; by Prof. R. H. Thurston, and many other eminent expert engineers, also railway master mechanics, as superior to any now in use, and filling all requirements.



GEO. VAN WAGENEN, Sole American Licensee and Manufacturer.

Illustrated Pamphlets on Application. 233 West Street, New York City.

WESTCOTT CHUCK CO., Formerly **Oneida Steam Engine & Foundry Co., ONEIDA, N. Y.**

Manufacturers of all kinds of Lathe and Drill

CHUCKS

SEND FOR Catalogue.

Scroll Combination. 3 or 4 Jawed. *Jaws reversible.* Diameter.	Capacity.
4 9-16 in.	5 1-2 in.
7 1-2 in.	8 in.
10 1-8 in.	12 in.
13 1-4 in.	15 in.
16 in.	18 in.
18 1-2 in.	21 1 2 in.
21 1-4 in.	26 in.
24 in.	30 in.
30 in.	36 in.
36 in.	43 in.

WESTCOTT'S PATENT.

Hydrostatic Machinery,

PRESSES, PUMPS, PUNCHES,

ACCUMULATORS,

Jacks, Valves,

FITTINGS,

Vault Elevators, Etc., Etc.

WATSON & STILLMAN,

204-210 E. 43d St., N. Y.

CHUCKS

WRITE US FOR PRICES.

THE HOGGSON & PETTIS MFG. CO.
Est. 1849. NEW HAVEN, CONN.

INDEPENDENT CHUCKS

(See AM. MACHINIST, Nov. 5, 1887.)

Before buying Chucks of this class, write us for particulars of our latest improvements. Different from other makes, and we claim several points of superiority which we submit to the judgment of mechanics.

THE O. E. WHITON MACHINE CO.,
NEW LONDON, CONN.

DIXON'S

SILICA

Graphite Paint

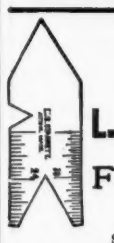
For Boiler Fronts and Smoke Stacks.

Two coats will last two years. Send for Circular. Equally good for all Iron Work exposed to extreme temperatures, salt air, acid fumes, etc.

Joseph Dixon Crucible Co.,

Manufacturers Pencils and Graphite Specialties.

JERSEY CITY, N. J.



L. S. STARRETT,
Manufacturer of
FINE TOOLS,
ATHOL, MASS.

SEND FOR FULL LIST.

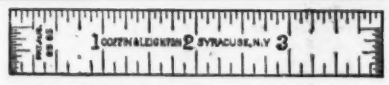
SHAPING MACHINES

FOR HAND AND POWER.
6", 8" and 10" Stroke.

Adapted to All Classes of Work to their Capacity.

Circulars Furnished.

BOYNTON & PLUMMER,
WORCESTER, MASS.



MACHINIST'S SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

TRADE MARK.

THE HORTON LATHE CHUCK!

Manufactured by

THE E. HORTON & SON CO.,
Windsor Locks, Conn., U. S. A.
Send for Illustrated Catalogue.

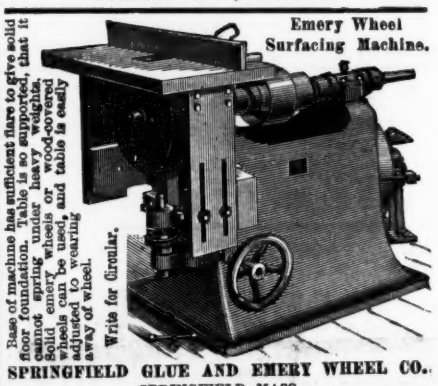
A NEW CATALOGUE OF

CUSHMAN CHUCKS

JUST ISSUED.

Containing new designs. Sizes and prices sent free on application to the

CUSHMAN CHUCK CO.,
HARTFORD, CONN.



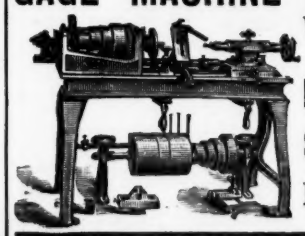
Emery Wheel Surfacing Machine.

Base of machine has sufficient flare to give solid floor foundation. Table by supporting, that it cannot spring under heavy work. Solid emery wheels or wood-covered wheels can be used, and table is easily adjusted to wearing away of wheel. Write for Circular.

SPRINGFIELD GLUE AND EMERY WHEEL CO.
SPRINGFIELD, MASS.

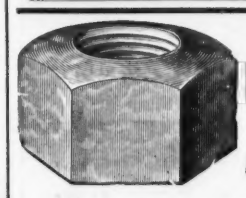
GAGE MACHINE WORKS,

Waterford, N. Y.



Manuf'r's of

FOX, TURRET AND SpeedLathes AND Brass Finishers' TOOLS.



FINISHED

HEXAGON NUTS.

Accurate to Gauge.

Orders Promptly Filled.

TRUMP BROS. M'CH CO.,
Wilmington, Delaware.

FRICTION

CLUTCH PULLEYS AND CUT-OFF COUPLINGS

JAS. HUNTER & SON,
North Adams, Mass.

Cosgrove's Patent Universal Vise Chuck.

For Milling Machines, Planers, Shapers, Drill Presses, Etc. Complete in every particular. Trunnion and base graduated, admitting of great range of positions and for registering same. Steel Jaws 8 in. x 2 in. Will stand hard usage. Circulars on application.

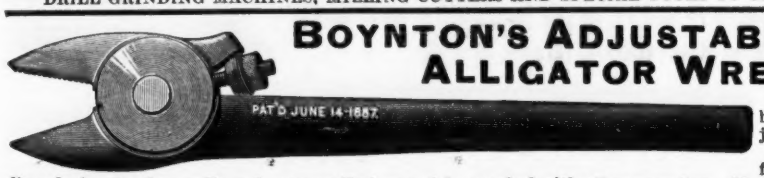
PEDRICK & AYER, PHILADELPHIA, PA.

MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford, Mass.

Manufacturers of **Morse Patent Straight-Lip Increase Twist Drills.**

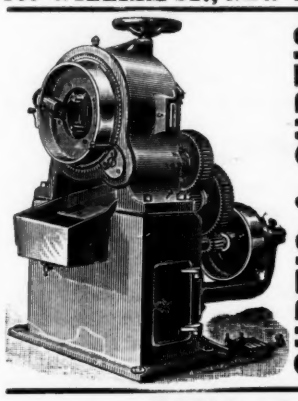
Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

BOYNTON'S ADJUSTABLE ALLIGATOR WRENCH.



Quick and handy in adjustment. Invaluable for work on clipped pipe, in close coils and corners that cannot be reached with other wrenches. Made entirely of drop forged steel. Six sizes. Manufactured by

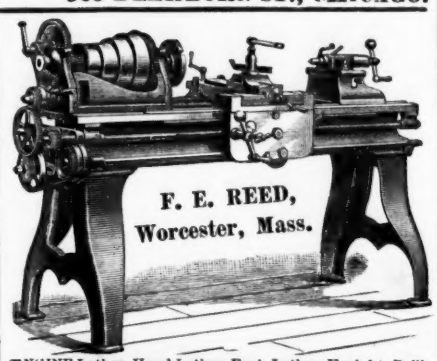
CAMPBELL PRINTING PRESS AND MFG. CO.
160 WILLIAM ST., NEW YORK. 325 DEARBORN ST., CHICAGO.



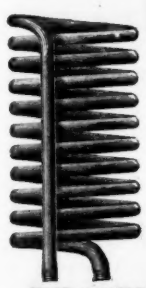
CURTIS & CURTIS,

66 GARDEN STREET, BRIDGEPORT, - CONN.

Pipe Cutting and Threading Machinery, FOR HAND OR POWER.



ENGINE Lathes, Hand Lathes, Foot Lathes, Upright Drills, and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.



COILS & BENDS

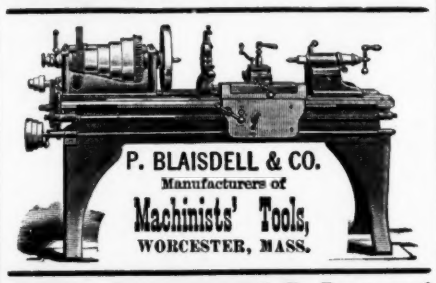
—OF—

IRON, BRASS and COPPER

PIPE.

ALL STYLES.

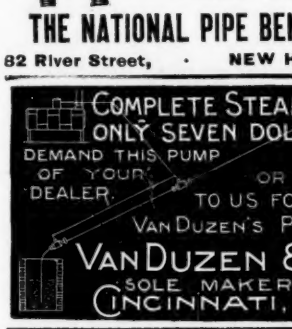
THE NATIONAL PIPE BENDING CO.,
82 River Street, · NEW HAVEN, CONN.



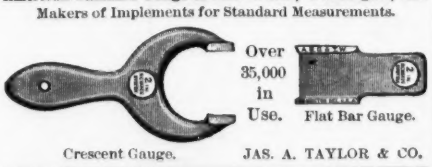
SOLDERING Iron and Steel RUST

may be done without causing

by using our **Non-Corrosive** Soldering Fluid.
Sample Bottle, prepaid, for 10 cents
FOR SALE BY ALL DEALERS.
STERLING ELLIOTT, NEWTON, MASS.



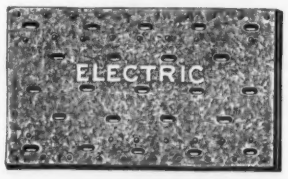
American Standard Gauge & Tool Works, Wilmington, Del.
Makers of Implements for Standard Measurements.



Over 35,000 in Use.

Crescent Gauge. Flat Bar Gauge. JAS. A. TAYLOR & CO.

ELECTRIC PERFORATED LEATHER BELTING!!



Prevents **AIR** Cushions. Guaranteed for *DYNAMOS*

Pat. May 24th, 1888.

CHAS. A. SCHIEREN & CO.,
(MANUFACTURERS.)
CHICAGO. PHILA. NEW YORK. BOSTON.

Do You use Glue?
Improved Steam Glue Heaters
without joints, and therefore free from leakage. Furnished with Plain Iron, Enameled Iron or Copper Pots. For Pattern Makers, Cabinet Makers, Joiners, Bookbinders, in fact, all who use Glue. Please mention this paper, and send for Price List to makers. Made in nineteen different styles.
PANCOAST & MAULE,
245 South Third Street,
PHILADA, PA
BUILD THESE

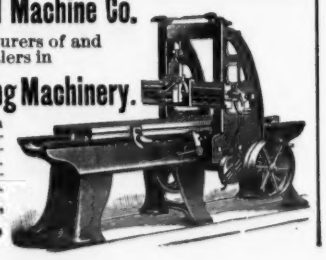
Sterling Emery Wheel Co.,
Factory, West Sterling, Mas
Office, 117 Dey Street, New York.
Our Wheels for Machine Shop Work and Tool Grinding Superior to all others.
Send for Catalogue just published.
Chicago Office, 41 South Canal St., Chicago, Ill

Lathes, Planers, Drills, Slotters, Etc.

NEW HAVEN MANUFAC'G CO.,
New Haven, Conn.

W. C. YOUNG & CO., Worcester, Mass Manufacturers of
Engine Lathes, Hand Lathes,
FOOT POWER LATHES, SLIDE RESTS, ETC.

L. W. Pond Machine Co.
Manufacturers of and Dealers in
Iron Working Machinery.



Improved Iron Planers a specialty. Feed, patented Feb. 9, 1886. Belt Shifter, patented Nov. 2, 1886.
140 Union St., Worcester, Mass.

D. SAUNDERS' SONS, Yonkers, N.Y.

Steam & Gas Fitters' Hand Tools.
SEND FOR CIRCULAR.

MANUFACTURERS OF
Pipe Cutting, THREADING, AND Tapping Machines.

THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe-cutter made.

BUFFALO BLOWERS

FOR CUPOLAS, FORGES, FURNACES &C. EXHAUSTERS, STEAM FANS HEATERS & VENTILATING WHEELS.

BUFFALO FORGE CO. BUFFALO, N.Y.

Cincinnati Centennial Exposition.

To the Committee on Rules, Jurors and Awards.

GENTLEMEN:

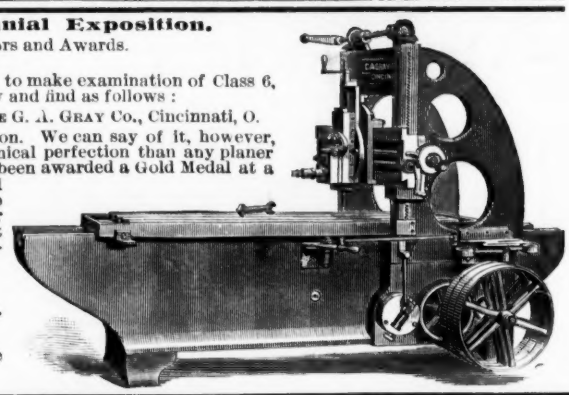
We, your Committee appointed to make examination of Class 6, Group 41, have performed that duty and find as follows:

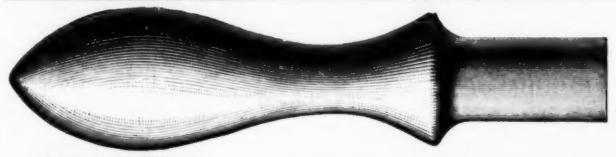
PLANING MACHINE. THE G. A. GRAY CO., Cincinnati, O.

This machine has no competition. We can say of it, however, that it approaches nearer to mechanical perfection than any planer we have ever examined. As it has been awarded a Gold Medal at a former Exposition (Cincinnati,) and as the highest award we could make under the rules would be a Silver Medal, we do not wish to detract from its Golden Record, and therefore make no award.

D. D. MARTIN, WM. CORRY, M. L. ANDREW. } *Jurors.*

The Board of Commissioners have awarded a Silver Medal.

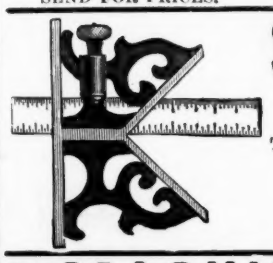




DROP FORGINGS.

WYMAN & GORDON,
Worcester, Mass.

SEND FOR PRICES.



STANDARD TOOL CO.,

ATHOL, MASS.,

MANUFACTURERS OF

The Celebrated Chaplin Try and Center Square, Standard Steel Rules, Steel Caliper Rules, Universal Bevels, Caliper Gauges, Improved Surface Gauges, Bevel Protractors, Depth Gauges, Screw Pitch and Center Gauges, Hardened Steel Squares, Graduated Steel Squares, Spring Calipers, Pliers, Straight Edges, &c., &c.

WRITE FOR ILLUSTRATED CATALOGUE AND PRICE LIST OF FULL LINE.

MACHINERY

For Reducing and Pointing Wire.

ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.

For Machines or information, address the manufacturer,

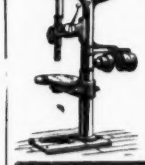
S. W. GOODYEAR, Waterbury, Ct.

We never sleep.

JONES & ROGERS,
5 West 4th St., Cincinnati, O.,
CONSULTING ENGINEERS.
Machinery Designers.
Standard Drawings Made.
Blue-Printing a Specialty.
WE CAN SAVE YOU MONEY.
WRITE TO US.

DELAFIELD'S PAT. SAW CLAMP

With Saw for Cutting Metals. Saves all the broken hack saw blades. In use over two years, in all parts of the country. The new Clamps have the edges beveled that hold the saw. Free by mail for 50 cents. Extra blades, 1-2 in. wide, 7c. each. 70c. per doz; 1 in. wide, Stubs, 35c. each. Free by mail.
NOROTON MFG. WORKS, NOROTON, CONN.



DRILLING MACHINES.

ALL STYLES WITH
Latest Designs and Improvements.
For cuts and prices address,
BICKFORD DRILL CO.,
Front & Pike Sts., Cincinnati, O.

MONTGOMERY & CO.,
105 FULTON ST., NEW YORK,
TOOLS, SUPPLIES AND MACHINERY
FOR ALL BRANCHES OF THE MECHANICAL TRADES.
Illustrated Catalogue (300 pages) mailed on receipt of Fourteen Cents.

IF YOU ARE INTERESTED IN ***INVENTIONS***
And Care for Facts About
PATENTS, Send for PAMPHLET No. 2, for MECHANICS AND INVENTORS.
I. B. CHAMBERLAIN, 500 Fifth St., Washington D. C.

BEVEL GEARS,

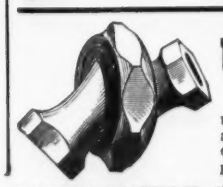
Cut Theoretically Correct.
For particulars and estimates apply to
HUGO BILGRAM,
Machinist,
Successor to
BREHMER BROS.
440 N. 12th St., Philadelphia, Pa.

WILLIAM BARKER & CO.,

Manufacturers of

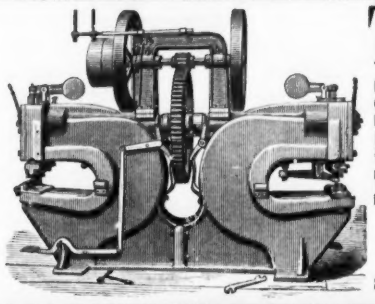
Iron and Brass Working
MACHINERY
140 & 142 E. Sixth St.,
Near Culvert,
CINCINNATI, O.

HODGE'S
Universal Angle Union
PATENTED.

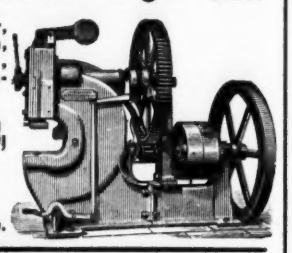


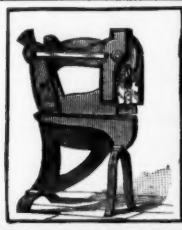
Combining an elbow and union, and can be set at any angle at which it is desired to run the pipe.
Manufacturers & Wholesale Agents,
ROLLSTONE MACHINE CO., 45 Water St., FITCHBURG, MASS.

WILLIAM SELLERS & CO., Incorporated.
PHILADELPHIA, PA.
BUILDERS OF
MACHINE TOOLS FOR WORKING IRON AND STEEL,
Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.
NJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE.

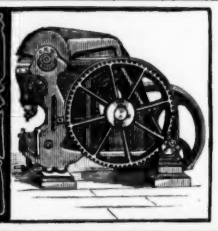


THE LONG & ALLSTATTER CO. Hamilton OHIO.
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven
Punches and Shears,
OVER 300 SIZES.
ALSO
Power Cushioned Hammer.
Send for New Catalogue.



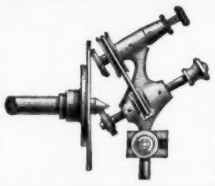


PUNCHING AND SHEARING MACHINERY
AND BOILER MAKER'S ROLLS.
NEW DOTY MANUFACTURING CO.
JANESVILLE, WISCONSIN.



Exhaust Tumbling Barrels.

Henderson Bros.
MANUFACTURERS,
WATERBURY, CT.
SEND FOR CIRCULAR.

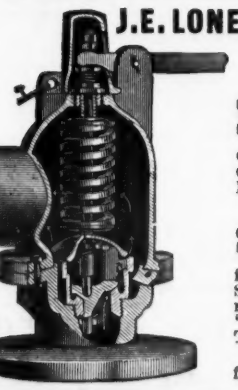


ENERGY MFG. CO.,
1115 South 15th St.,
PHILA., PA.
Sole makers of Rope Hoisting Machines, Drill Guides, etc. Two sizes of Center Grinders, for small and large lathes. Will true up centers quicker than any other device. Send for descriptive circular of specialties.

STEEL CASTINGS
From 1-4 TO 15,000 lbs. WEIGHT.
True to pattern, sound, solid, free from blow-holes and of unequaled strength.
Stronger and more durable than iron forgings in any position or for any service whatever.
40,000 CRANK SHAFTS and 30,000 GEAR WHEELS of this steel now running prove this.
Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives.
STEEL CASTINGS of every description.
Send for Circulars and prices to
CHESTER STEEL CASTINGS CO.,
Works, Chester, Pa. Office 407 Library St., Philadelphia, Pa.

THE LAIDLAW & DUNN CO.

PUMPS OF EVERY DESCRIPTION. CINCINNATI, O. SEND FOR CIRCULAR.

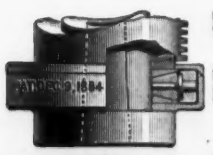


J.E. LONERGAN & CO.
211 Race St., Phila.
Manufacturers of
PATENT OILERS,
Cylinder Sight Feed Cups. Government Regulation
POP
SAFETY VALVES
for Locomotive Stationary and Marine Boilers, also the "Reliable" Steam Trap.
1888 Catalogue free on application.

J. A. FAY & CO. CINCINNATI, OHIO, U.S.A.
BUILDERS OF IMPROVED
WOOD-WORKING MACHINERY
Embraces nearly 400 Machines for
PLANING & MATCHING
Surfacing, Moulding, Tenoning, Mortising, Boring, and Shaping, etc.
Variety and Universal
WOOD WORKERS.
Band, Scroll and Circular Saws, Resawing Machines, Spoke and Wheel Machinery, Shafting, Pulleys, etc. All of the highest standard of excellence.
W. H. DOANE, Pres. D. L. LYON, Sec'y.

WANTED TOOL AGENTS in Shops South and West of Penna. Send 10c. for Postage on Free Outfit.
C. B. JAMES, 98 Lake St., Chicago.
(Successor to E. H. RANDALL & CO.)

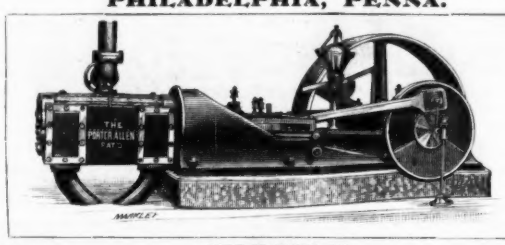
WELDLESS STEEL QUICK OPENING GATE VALVE. COLD DRAWN TUBES
SMOOTH INSIDE & OUT.
JOHN S. LENG, 4 Fletcher St. N.Y.



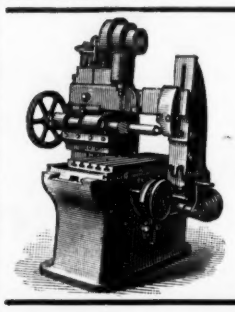
THE BROWNELL ANTI-FRICTION
Step or Thrust Bearing
FOR
Lathes, Drills, Worm Shafts of Elevators or Hoists, Jack Screws, Mill Stones, Water Wheel and Propeller Shafts.
Bearings of all sizes made to order, and patent rights for sale by
G. L. BROWNELL,
WORCESTER, MASS.
Correspondence Solicited.

OPEN SIDE IRON PLANERS
FOR QUICK DELIVERY.
1 30"x25"x 6 ft. Size "C."
1 30"x25"x 8 ft. Size "C."
1 30"x25"x10 ft. Size "C."
1 36"x30"x 8 ft. Size "D."
1 36"x30"x10 ft. Size "D."
1 48"x36"x10 ft. Size "E."
1 48"x36"x14 ft. Size "E."
1 48"x48"x12 ft. Size "E. 1."
1 48"x48"x14 ft. Size "E. 1."
WRITE FOR PRICES, PHOTOTYPES, Etc.
Detrick & Harvey,
BALTIMORE, MD.

Southwark Foundry and Machine Company
PHILADELPHIA, PENNA.
BOILERS. TANKS. STEAM HAMMERS. HEAVY CASTINGS.

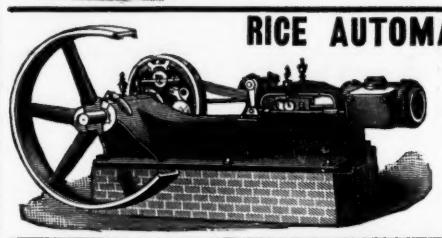


BLOWING AND REVERSING ENGINES. CENTRIFUGAL PUMPS. STEAM PUMPS
SOLE MAKERS OF
PORTER-ALLEN AUTOMATIC ENGINE.
HIGH ECONOMY. DURABILITY. CLOSE REGULATION.



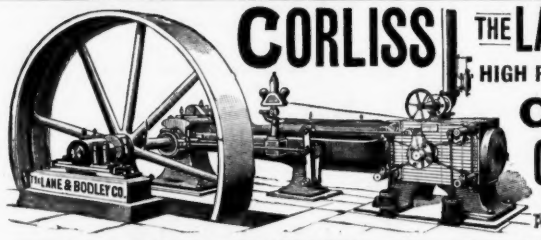
BEMENT, MILES & CO.,
PHILADELPHIA, PA.
—BUILDERS OF—
METAL-WORKING MACHINE TOOLS
FOR
Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works, Etc., Etc.

RICE AUTOMATIC CUT-OFF ENGINE.



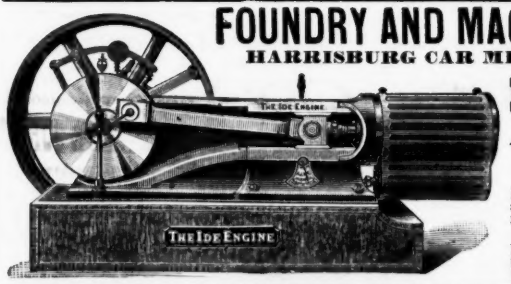
Self-Contained. Sensitive Governor. Balanced Valve. High Speed. Stationary Oilers. Best Economy.
Gold Medal Cincinnati Exposition, 1884.
THE JOHN T. NOYE MFG. CO.,
BUFFALO, N. Y.

CORLISS THE LANE & BODLEY CO.
HIGH PRESSURE, CONDENSING and
COMPOUND CORLISS ENGINES AND **STEAM OUTFITS**



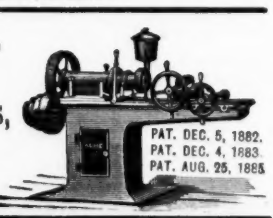
THE LANE & BODLEY CO., EAST SIDE JOHN, Corner WATER ST. CINCINNATI, O.

FOUNDRY AND MACHINE DEPARTMENT.
HARRISBURG CAR MFG. CO., HARRISBURG, PA.



Highest Award SILVER MEDAL and DIPLOMA
AT FRANKLIN INSTITUTE NOVELTY EXHIBITION, PHILADELPHIA.
We are operating the finest and most successful Electric Light Stations in the world. A change of speed not exceeding one per cent. guaranteed, running light and loaded. Send for catalogue.
New York Office, Fleming & Kimball, 17 Dey St. New England Office, John Post, Jr. & Co., 70 Kilby St., Boston. Baltimore Office, Thomas K. Carey & Bro., 35 Light St., Baltimore.

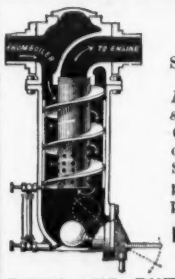
ACME MACHINERY CO.
CLEVELAND, OHIO.
Manufacturers of "ACME"
Single & Double Automatic Boltcutters,
Cutting from 3-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
Send for Catalogues and Discounts.
FIRST PREMIUM, CINCINNATI CENTENNIAL.



VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

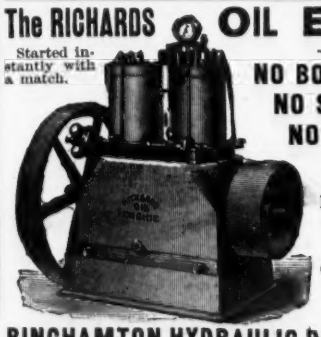
BORING AND TURNING MILLS
LATHES PLANERS DRILL PRESSES
F. P. MICHEL ROCHESTER N.Y.

SIMPSON'S CENTRIFUGAL SEPARATOR AND TRAP.



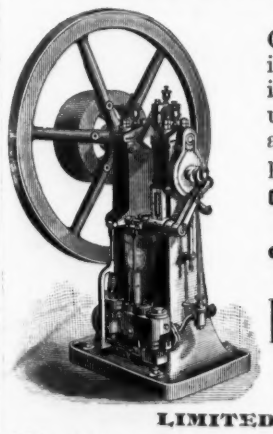
For supplying Clean and Dry Steam to Engines, Dryers, Etc.
Also *Keystone Feed-Water Heaters and Purifiers. Keystone Belt Pumps, Simpson's Centrifugal Exhaust Heads* and other Engineering Specialties. Steam Plants furnished complete and erected. Send for particulars.
KEYSTONE ENGINE AND MACHINE WORKS,
FIFTH AND BUTTONWOOD STS. PHILA.,
Or, ARTHUR APPLETON, Selling Agent, 45 Cortlandt St., N. Y.

The RICHARDS OIL ENGINE.
Started instantly with a match.



NO BOILER. NO STEAM. NO DANGER.
Fuel, Crude Petroleum or Kerosene.
Cheaper than all others.
BINGHAMTON HYDRAULIC POWER CO.
BINGHAMTON, N. Y., U. S. A.,
SOLE MANUFACTURERS.

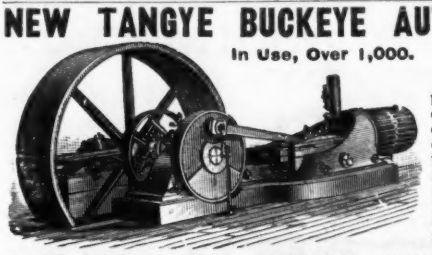
KORTING GAS ENGINE.
1 to 100 Horse Power.



The Korting Gas Engine is placed upon its merits and under full guarantee to every purchaser.
OVER 125 IN USE IN N. Y. CITY.
CATALOGUES on APPLICATION.
KORTING GAS ENGINE CO.,
LIMITED.
429, 431 & 433 Greenwich Street,
Cor. Laight Street, NEW YORK CITY.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 1,000. 25 to 1,000 H. P.



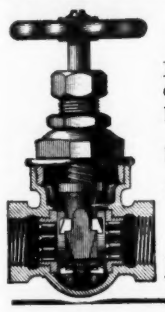
These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H.P. for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

SALES AGENTS: **W. L. SIMPSON,** 301 TELEPHONE BUILDING, 18 CORTLANDT STREET, N. Y. | N. W. ROBINSON, 154 Washington St., Chicago, Ill. ROBINSON & CARY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.

BLESSING'S RENEWABLE-SEAT GLOBE, STRAIGHTWAY and CHECK VALVES.



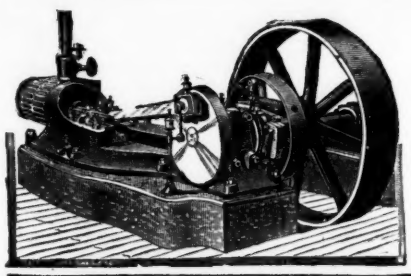
The Renewable Seats and Disks are cast from the best Phosphor Bronze Metal, which has lasting qualities, double that of the best Steam Metal commonly used in first-class valves. The seats are simply screwed to place by the use of a special wrench furnished with each valve.

These valves are equally applicable to steam, water, or other fluid pressure.

We also manufacture **Blessing's Albany Steam Traps, Water Circulator and Purifier; and Pump Governor.**

SEND FOR CIRCULAR.

ALBANY STEAM TRAP CO., Albany, N. Y.



Russell & Co.

MASSILLON, OHIO,

BUILDERS OF

AUTOMATIC ENGINES

BOILERS, ETC.

Complete Power Plants Furnished and Erected.

SEND FOR CATALOGUE.

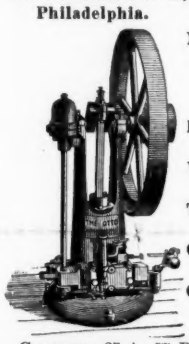
"OTTO" GAS ENGINE WORKS.

SCHLEICHER, SCHUMM & CO.,

33d & Walnut Streets, Philadelphia. 130 Washington Street, Chicago.

New York Agency, 18 Vesey St.

OVER 25,000 ENGINES SOLD.



HORIZONTAL "Otto" Gas Engines.

VERTICAL "Otto" Gas Engines.

TWIN CYLINDER "Otto" Gas Engines.

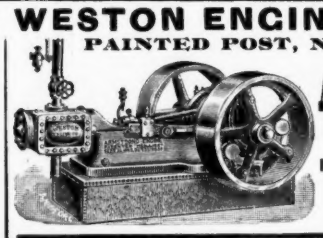
COMBINED "OTTO" GAS ENGINES AND PUMPS.

COMBINED "OTTO" GAS ENGINES AND DYNAMOS.

Consume 25 to 75 Per Cent. Less Gas than ANY other Gas Engine doing the same work

WESTON ENGINE CO.

PAINTED POST, N. Y.



THE ARMSTRONG ENGINE.

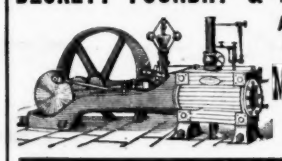
CORRECT IN Design, Workmanship and Price.

5 to 75 H. P.

BECKETT FOUNDRY & MACHINE CO.,

ARLINGTON, N. J.

Manufacturers of



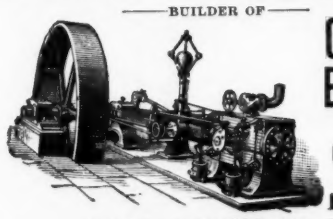
MUNZER CORLISS ENGINES.

PATENTS

THOMAS P SIMPSON, Washington, D.C. No atty's fee until Patent obtained. Write for Inventor's Guide.

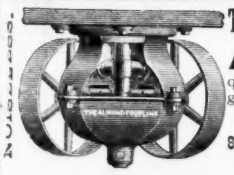
JOHN McLAREN,

BUILDER OF



CORLISS Engines, AIR Compressors and BOILERS.

HOBOKEN, N. J.



The Almond Coupling

A NEW quarter turn motion to replace quarter turn belts and bevel gears.

T. R. ALMOND, MFR., 83 and 85 Washington Street, BROOKLYN, N. Y.

ATTENTION NEW ENGLAND BUYERS.

We have opened at 23 and 25 Purchase St., Boston, a depot for the exhibition and sale of our Improved Engine Lathes, Shapers, Drill Presses and Brass Working Machine Tools, &c. We make a feature of Complete Engine Lathes, without charge for extra attachments.

Call and examine them. Cuts, with full descriptions, free.

LODGE, DAVIS & CO.

23 & 25 Purchase St.,

BOSTON.

WORKS, Cincinnati, Ohio.

See Advertisement, Page 16.

MACHINERY ON HAND.

16 in. x 42 in.	Planer.	Bridgeport,	new
20 in. x 5 ft.	"	Lincoln,	cheap.
20 in. x 6 ft.	"	P. & W.,	good.
22 in. x 5 ft.	"	Hendey,	new.
22 in. x 5 ft.	"	Powell,	"
24 in. x 6 ft.	"	Powell,	"
30 in. x 8 ft.	"	each Atherton, Powell & H. & P.	new.
6-8-10-12-15 in. Crank Shapers.			
15 x 20 in. Friction Shapers.			
20-24-26 and 32 in. Geared Shapers.			
13 in. x 5 1-2 ft. Engine Lathe,		S. M. & Co.	new.
12 in. x 6 ft.	"	Young,	"
13 in. x 6 ft.	"	Ames,	"
14 in. x 6 ft.	"	Blaisdell,	"
14 in. x 7 ft.	"	Bogart,	"
14 in. x 6 ft.	" Gap Bed,	S. M. & Co.,	"
15 in. x 6 and 8 ft.	"	Porter,	"
16 in. x 6 and 8 ft.	"	Blaisdell,	"
16-20 in. x 6-8-10 & 12 ft.		Bridgeport,	"
18 in. x 8-10-12 ft.	"	Different Makes,	"
20 in. x 8-10-14 ft.	"	Different Makes,	"
20 in. any length Bed	"	Bridgeport,	"
22 in. x 12 ft.	"	Niles,	heavy, good.
23 in. x 8-10-12 & 14 1 2	"	Bridgeport,	new.
28 in. x 14-16 & 18 ft. Engine Lathes,		T. & S.	"
20 in. Drill		Davis,	"
20-23-25-28 inch Drills		Blaisdell,	"
20-25-28-32 inch	"	C. & S.	"
5 ft. Arm Universal Radial Drill,			"
Cabinet Turret Lathe, Lodge, Davis & Co.			"
No. 5 Screw Machine, Jones, Lamson & Co.			"
No. 2-4	"	Brown & Sharpe.	"
1200 lb. Drop Hammer,		Merrill,	A1
No. 2 and 4 Stiles Punch Press,			good
Ames Index Milling Machine,			fair.
No. 2 Garvin Hand Miller,			A 1.
No. 5 Brainard	"		A 1.
Lincoln Pattern,	"		good order.
No. 1 and 3 Universal Miller, Brown & Sharpe,			new.
No. 1-2 and 5 Plain	"	"	"
No. 1 Universal Grinder,	"	"	"
No. 3 Surface Grinder,	"	"	A 1.

Cold Rolled Shafting in Stock. Send for list. Write for what is wanted.

E. P. BULLARD,

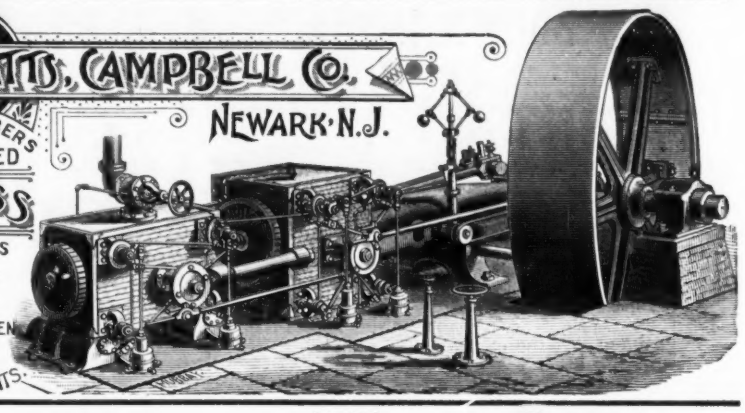
62 COLLEGE PLACE & 72 WARREN ST., NEW YORK.

THE WATTS, CAMPBELL CO.

NEWARK, N. J.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

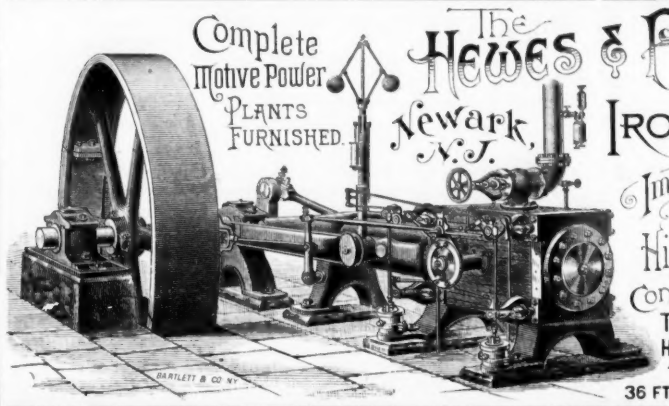
CONTRACTS TAKEN FOR COMPLETE POWER PLANTS.



The Hewes & Phillips Iron Works

Newark, N. J.

Complete Motive Power Plants Furnished.



Improved CORLISS ENGINES, High Pressure. Condensing and Compound

TUBULAR BOILERS.

HEAVY FLY WHEELS A SPECIALTY. IN SIZES UP TO 36 FT. DIA. BY 10 FT. FACE.

Eclipse Corliss Engine.

FRICK COMPANY, Builders,

WAYNESBORO, PA.

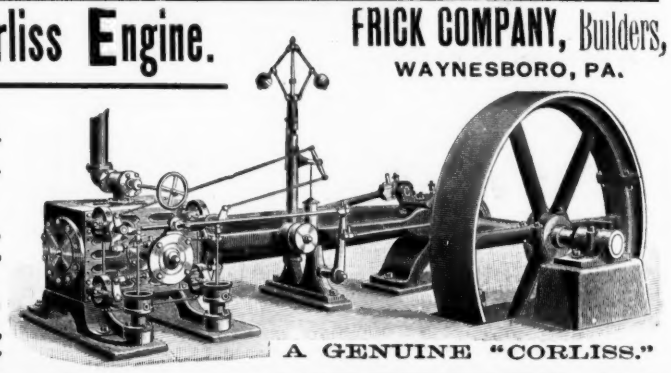
NON-CONDENSING, CONDENSING COMPOUND.

40 TO 1,000 H.P.

Send for Circulars.

E. P. HAMPSON & CO., 36 CORTLANDT ST., NEW YORK, Sole Eastern Agents.

JOHN J. METZGER, 69 S. Clinton St., Chicago, WESTERN AGENT.

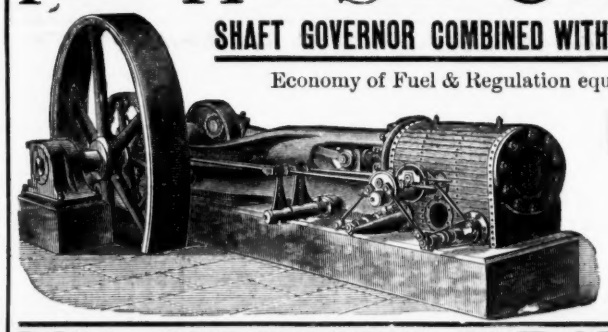


A GENUINE "CORLISS."

PAYNE HIGH SPEED CORLISS ENGINE.

SHAFT GOVERNOR COMBINED WITH CORLISS WRIST-PLATE.

Economy of Fuel & Regulation equal to anything in use.



B. W. PAYNE & SONS

ELMIRA, N. Y.

45 Dey St., New York.

Hill, Clarke & Co., Boston, Mass.

10 S. Canal St., Chicago, Ill.

BALL AUTOMATIC CUT-OFF ENGINES,

ERIE, PA.

The characteristics of these Engines are Beauty of Design, Superior Finish, Limited Feet in Space required, Economy of Fuel, Perfection of Regulation.

CHARLES R. VINCENT & CO.,

NEW YORK SELLING OFFICE, 15 CORTLANDT STREET.

STEARNS M'F'G CO.

ERIE, PA.

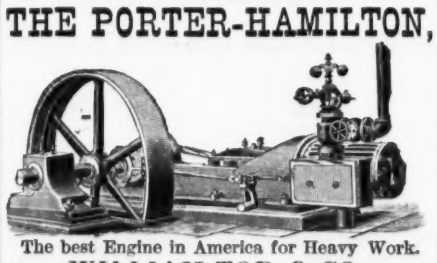
ENGINES from 15 to 400 Horse Power

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogue.

SAW MILLS and GENERAL MACHINERY

NEW YORK STORE, 46 Cortlandt St.

THE PORTER-HAMILTON,



The best Engine in America for Heavy Work.

WILLIAM TOD & CO., Youngstown, Ohio.

HILL, CLARKE & CO.

List of Second-Hand

MACHINERY

TAKEN IN TRADE FOR NEW.

11" x 5' Engine Lathe,	F. E. Reed.
12" x 5' Engine Lathe,	Prentice, (new).
14" x 6' Engine Lathe,	Flather, (new).
15" x 6' Engine Lathe,	Lathe & Morse.
16" x 6' Engine Lathe,	Powell
16" x 6' Engine Lathe,	Blaisdell.
20" x 8' Engine Lathe,	Powell.
21" x 10' Engine Lathe,	Lathe & Morse, (new).
37" x 14' Engine Lathe,	Gleason, (new).
Cabinet Turret Lathe,	Lodge, Davis & Co. (new).
16" x 16" x 3' Planer,	Lathe & Morse.
22" x 22" x 5' Planer,	Hendey.
26" x 26" x 6' Planer,	Hendey.
30" x 30" x 8' Planer,	Bement.
36" x 36" x 10' Planer,	Whitcomb, (new).
15" Stroke Shaper,	Hendey.
Crank Planer,	Lathe & Morse.
20" Upright Drill,	Prentice.
22" Upright Drill,	Reed.

Above 2d-hand tools are in first-class condition. Write for prices and descriptions.

156 OLIVER STREET

BOSTON, MASS.

BROWN & SHARPE MFG. CO.,
PROVIDENCE, R. I.

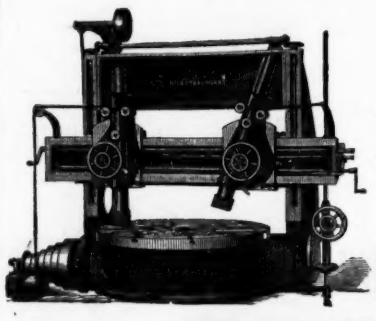
PATENT MICROMETER CALIPERS.

NUMBER.	CAPACITY.	READINGS.	STYLE.	PRICE.
1	3/10 in.	1/1000 in.	Beveled Measuring Points	4.00
1	3/10 in.	1/10000 in.	Large Surfaces for Measuring Paper, &c.	5.50
2	1/2 in. or 12 1/2 mm.	1/1000 in. or 1/100 mm.	Beveled Measuring Points	4.50
3	1/2 in.	1/10000 in.	Beveled Measuring Points	5.50
4	1/2 in. or 12 1/2 mm.	1/1000 in. or 1/100 mm.	Square Measuring Points	5.00
5	1/2 in.	1/10000 in.	Square Measuring Points	6.00
8	1 in.	1/1000 in.	E Shaped Frame	4.50
9	25 mm.	1/50 mm.	E Shaped Frame	4.50
15	1 in. or 25 mm.	1/1000 in. or 1/100 mm.	Beveled Measuring Points	5.00
16	1 in.	1/10000 in.	Beveled Measuring Points	6.00
17	1 in.	1/1000 in.	No. 15 with Clamp Screw	5.75
19	1 in.	1/1000 in. or 1/100 mm.	Square Measuring Points	5.50
20	1 in.	1/10000 in.	Square Measuring Points	6.50
30	2 in. or 50 mm.	1/1000 in. or 1/100 mm.	Measures from 0 to 2 in. or 0 to 50 mm.	8.00

Catalogues or Illustrated Circulars mailed on application.

Boring AND Turning Mills,

5, 6, 7, 8, 10, 12, 14 and 16 FT. SWING.



NEW MACHINE,

14-20 ft. Boring and Turning Mill. Housings and upper works arranged to slide back to take in work 20 ft. diameter. Has independent boring and key seating attachment.

NILES TOOL WORKS
Hamilton, Ohio.

NEW YORK, 96 Liberty Street. PHILADELPHIA, 705 Arch St. CHICAGO. 96 Lake Street.

CRANES
THE YALE & TOWNE MFG CO.
STAMFORD CONN
NEW YORK CHICAGO PHILA BOSTON

JENKINS BROS. VALVES.

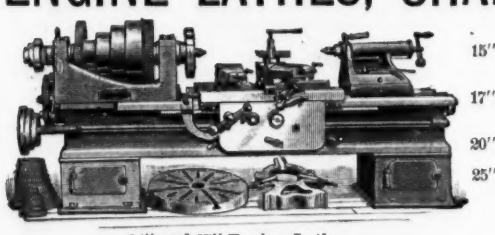
THE ENDORSEMENT OF FIRST-CLASS ENGINEERS AND MECHANICS THROUGHOUT THE COUNTRY has fully demonstrated these valves to possess the following advantages over all other valves now in use:

1.—A perfectly tight valve under any and *all pressures of steam, oils, or gases.* 2.—Sand or grit of any kind will not injure the seat. 3.—You do not have to take them off to repair them. 4.—They can be repaired by any mechanic in a few minutes. 5.—The elasticity of the Disc allows it to adapt itself to an imperfect surface.

In Valves having ground or Metal seats, should sand or grit get upon the seat, it is impossible to make them tight, except by regrinding, which is expensive if done by hand, and if done by machine soon wears out the valve, and in most cases they have to be disconnected from the pipes, often costing more than a new valve. The Jenkins Discs used in these valves are manufactured under our 1880 patent, and will *stand any pressure of steam, oils, or acids.*

JENKINS BROS., 71 John St., N. Y.; 105 Milk St., Boston; 21 North Fifth St., Phila.; 54 Dearborn St., Chicago.

ENGINE LATHES, SHAPERS & DRILLS.



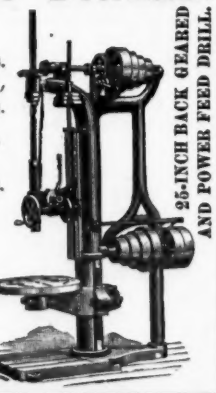
24" and 27" Engine Lathe.

15" 20" 26" 32" Shapers.

17" 19" 21" 24" 27" and 38" Engine Lathes.

20" 24" Upright Drills.

25" 28" 32" 40" B. G. P. F. Drills.



25-INCH BACK GEARED AND POWER FEED DRILL.

LODGE, DAVIS & CO.,
CINCINNATI, OHIO.

SEND FOR PRICES. IT WILL PAY YOU.

See advertisement, page 15.

E. GOULD & EBERHARDT,
NEWARK, N. J.

Eberhardt's New Drill

Turns out 30 per cent. more work than any other. APPLY TO

AND RACK CUTTING TO ORDER.

E. E. GARVIN & CO.

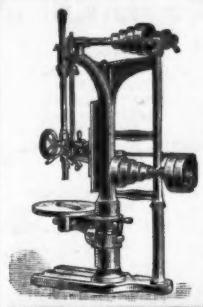
139 & 141 CENTRE STREET, NEW YORK.

Manufacturers of MACHINISTS' TOOLS

SMALL AUTOMATIC MILLER, WITH ARM.

The Machine shown in cut is designed for rapid and convenient milling of small work.

Send for Catalogue.



THE PRATT & WHITNEY CO.,
Hartford, Conn.,

MANUFACTURE

Renshaw's Ratchet Drills, Nos. 1 and 3; **Upright Self-Feeding Hand Drilling Machines** for Blacksmiths; **Upright Drilling Machines,** single and multi-spindle, both those in which the spindles are without feed movement and tables are operated by hand or foot lever, and those in which the tables have provision for adjustment, and spindles are fed by hand lever, or by hand wheel, or automatically; also, **Horizontal Drilling Machines,** single and multi-spindle.

WESTERN BRANCH, 100 West Washington St., Chicago, Ills.

THE BILLINGS & SPENCER CO.
HARTFORD, CONN. U.S.A.

MANUFACTURERS OF BILLINGS' DROP FORGED LATHE DOGS FORGED FROM BEST STEEL FOR THE PURPOSE

IN 12 SIZES 3/8 UP TO AND INCLUDING 4 IN. ALSO CLAMP AND DIE DOGS

DROP FORGINGS OF COPPER, IRON AND STEEL OF ALL DESCRIPTIONS.

WARNER & SWASEY,
CLEVELAND, OHIO,

MACHINE TOOLS
For Iron and Brass Work.

SMALL TOOLS & FIXTURES.

Gear Cutting in all its Branches.

ILLUSTRATED CATALOGUE ON APPLICATION.

GEO. W. FIFIELD,
MANUFACTURER OF
ENGINE LATHES
FROM 16 to 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

Gear Wheels and Gear Cutting.—I make g to order, or cut teeth on g blanks sent to me. Of all kinds. Of all sizes to six ft. dm. Small orders or large ones. Fine g or cheap g. Small cast g. Ready made brass g by mail at low prices. Bevel g with perfect planed teeth. Hand Book or g, $1. Facilities complete. Terms reasonable. Send for cat. GEO. B. GRANT, 66 Beverly St., Boston, Mass.

KEY-SEATING MACHINES
AND
20 in. Drills a Specialty.

Our 20 in. Drill is a heavy substantial tool, made for service, has steel shafts and spindle. Gears and racks cut from the solid, and have all modern improvements, are made by special machinery, and sold very low.

Our Key-Seating Machine will save enough in 60 days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment, both Key-Seat Machines and 20 in. Drills. Send for Photo. and Catalogue.

W. P. DAVIS, North Bloomfield, N. Y.

REMOVAL.
THE POND MACHINE TOOL COMPANY,
Formerly of Worcester, Mass.

The new shops of this company are located at Plainfield, N. J., forty minutes' ride from New York city on the line of the Central Railroad of N. J., and consist of the following:

A machine shop 500' long by 100' wide; a foundry 250' long by 90' wide; also commodious buildings for the storage of sand, coal, coke and pig iron; ample and convenient wash rooms for the men; fireproof two story pattern storage; blacksmith shop; engine and boiler houses. These buildings are detached from the machine shop and foundry. There is an elevated railroad for the convenient distribution of raw materials, and a railroad running through the machine shop for shipping. The whole plant is supplied with the incandescent system of electric lighting.

The machine shop and foundry have overhead traveling cranes running through their entire lengths; also light traveling cranes, which serve every tool, and a number of jib cranes in the foundry and scratch rooms. The foundry has capacity for making the heaviest class of castings.

All our tools are expressly designed for the economical manufacture of heavy machinery for railroad and general machine shop equipment, from new patterns of the latest and best designs.

SALESROOM and OFFICE, 111 & 113 Liberty St., N. Y. City.
NEW SHOPS, Plainfield, N. J.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

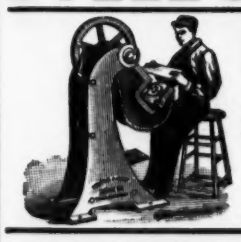
HARTFORD, CONN.

J. M. ALLEN, PRESIDENT.
W. B. FRANKLIN, VICE-PRESIDENT
J. B. PIERCE, SECRETARY.

PATENT UNIVERSAL SCREW-CUTTING CENTER DEPTH ANGLE AND **TWIST DRILL GAUGE.**
J. WYKE & CO., Fine Machinists' Tools.—E. Boston, Mass.—Send for Circular.

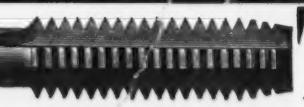
NEW CATALOGUE
MACHINE TOOLS.
THE G. A. GRAY CO.,
477-481 SYCAMORE ST., CINCINNATI, O.
See advertisement, page 13.

STEEL CASTINGS.
PRATT & LETCHWORTH,
PROPRIETORS
Buffalo Steel Foundry,
BUFFALO, N. Y.



PUNCHING PRESSES, DIES,
And other Tools for the Manufacture of all kinds of
SHEET METAL GOODS, DROP FORGINGS, ETC, DROP HAMMERS.
STILES & PARKER PRESS CO.
MIDDLETOWN, CONN.
Branch Office and Factory 203, 205 and 207 CENTRE STREET, NEW YORK.

J. M. CARPENTER
PAWTUCKET, R. I.



Manufacturer —of— TAPS & DIES